Marine Engineering

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Fig. 1.—View of Sir W. G. Armstrong, Whitworth & Company's Armstrong Yard from Airplane

One of England's Largest Shipyards

Description of Sir W. G. Armstrong, Whitworth and Company's Armstrong Yard at Newcastle-on-Tyne

FEW firms can claim the same wide experience in merchant ship design and construction as the Sir W. G. Armstrong, Whitworth and Company, Ltd. The diversion of the resources of the Armstrong Naval Yard, which has now taken the place of this firm's world-known Elswick yard, to the building of merchant ships is of considerable importance and adds considerably to the large shipbuilding facilities of the British Isles.

Figs. 1 and 6 show the general layout of the yard, which covers a total area of 83 acres. It is bounded on the western side by a branch line of the North Eastern Railway, which runs approximately parallel with the river at this point.

The Armstrong yard is capable of building about 70,000 tons of steel a year into ships, so that the maximum annual output of merchant shipping may be taken as about 140,000 gross register tons.

An inspection of Fig. 6 will show that the river frontage, which has a total length of 4,350 feet, is about equally occupied by the building berths and the fitting out dock. The latter, which has a total length of 2,133 feet, is constructed of reinforced concrete and terminates at its southern end in a reinforced concrete ground-head adjacent to the first building berth.

The length of the dock is sufficient to accommodate three large vessels placed end to end, and the river is dredged to give a minimum depth of 32 feet at low water for a width of 100 feet in front of the dock.

It will be noted from Fig. 6 that the larger building berths are situated in the central portion of the yard.

The platers' shop and frame shop are as near as practicable to the building berths, and the fitting shops, stores, joiners' shops and other departments mainly engaged on work on vessels after launching are close to the fitting out dock.

Berths

As originally laid out, the yard was provided with nine building berths, but another berth has since been added at the southern end and the other berths in that vicinity have been increased in breadth so that the smallest can now accommodate a cargo vessel of over 10,000 tons deadweight capacity. The largest berth is of sufficient size to permit the construction of a vessel 1,000 feet in length and 120 feet beam. Adjoining this is a berth capable of taking a vessel 900 feet long by 110 feet beam, and the next berth can take a ship 800 feet long by 100 feet beam. The maximum dimensions of vessels that can be built on the seven remaining berths are all shown on Fig. 6. The three largest berths were designed for battleship construction and were therefore spe-

Fig. 2.—Panoramic View of Armstrong Yard,

cially strengthened by timber piling, a fact which makes them quite suitable for the construction of the largest and heaviest merchant vessels yet contemplated.

CRANES

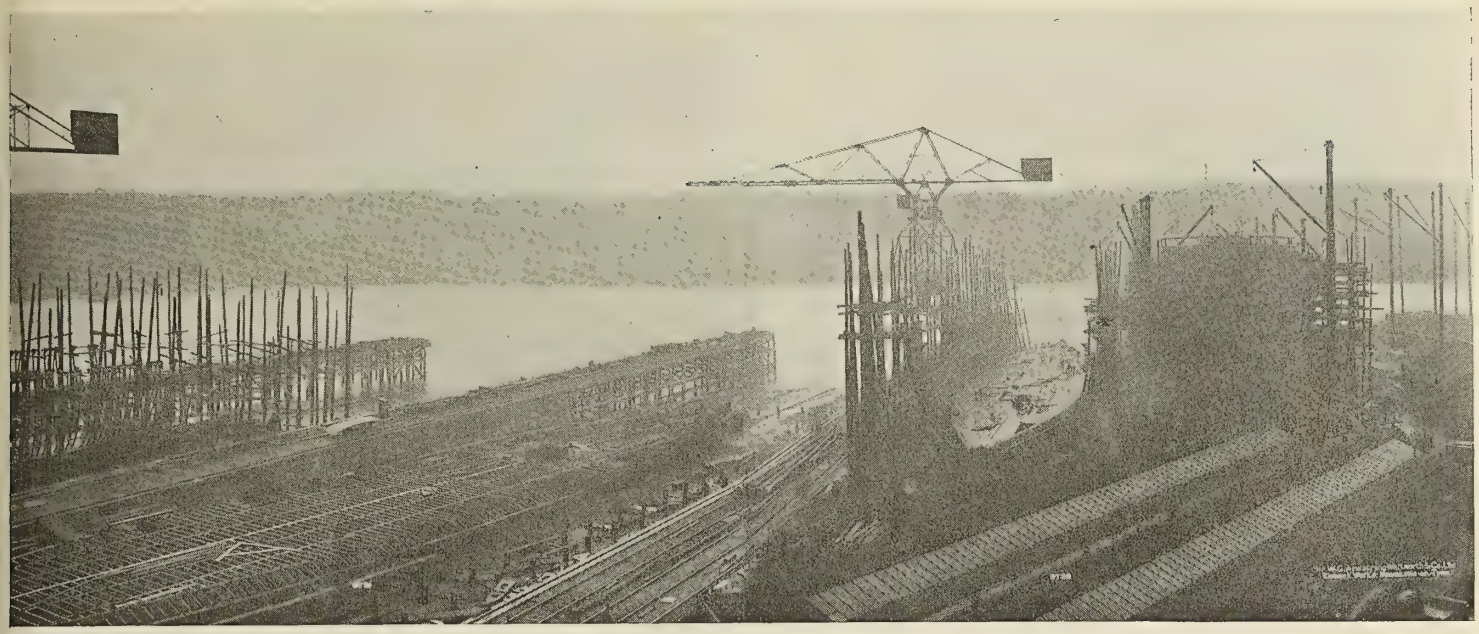
The crane equipment of a large shipbuilding yard is obviously a matter of the utmost importance, and this question was very carefully considered in laying out the Armstrong yard. The yard is at present equipped with nine electric traveling tower cranes, two of which are kept on each of the three jetties between the first four berths and another works on the fitting out dock. These cranes are designed to handle a load of 5 tons at a radius of 120 feet and a load of 10 tons at a radius of 60 feet. A clear lift of 90 feet above rail level is obtained.

The hoisting speed for a 5-ton load is 100 feet per minute, and a 10-ton load is hoisted at half this speed; the racking speed with a 10-ton load being 75 feet per minute and the traveling speed 80 feet per minute. In slewing, the cantilever arm makes a complete revolution in 2 minutes and the slewing motion is fitted with a special form of friction drive designed to absorb the shock to which the gearing might otherwise be subjected by a too sudden application of the brakes.

In addition to the traveling tower cranes, each of the large berths is provided with four electric winches with blocks and

Fig. 3.—Traveling Crane and Hydraulic Riveter

Fig. 4.—30-Ton Crane on Fitting-Out Dock



Showing Building Berths and Tower Cranes

tackle for shell work, and the six smaller berths at the southern end of the yard are each equipped with 10 masts and derricks with one electric winch for every two derricks. Most of the derricks are intended for loads of 3 tons, but 5-ton and 12-ton winches are provided here and there for specially heavy lifts. As shown in Fig. 6, a line of standard gage rails is laid between each of the smaller berths and 10-ton steam cranes operate on this line for general work. Seven of these 10-ton steam locomotive cranes are employed in various parts of the yard and there are also one 7-ton and three 5-ton and two 3-ton cranes of a similar type available for general use. One large shunting locomotive and four crane locomotives, capable of lifting 3 tons at the end of the jib and 5 tons at a smaller radius, are also employed in the yard.

Offices

The general offices are situated in a central position near the main entrance from Church street, Walker. Structurally the building is interesting on account of the fact that, in order to economize space, it was constructed on the embankment, so that it is six stories high on the yard frontage and only two stories high on the main entrance frontage. The building is a reinforced concrete skeleton structure 230 feet in length, its width being 122 feet at the top and 38 feet at the yard level. The height of the yard front is 100 feet and that of the entrance front 42 feet.

Entering the building through the main entrance a large model hall measuring 70 feet by 37 feet is first reached. To the left of this is the designing office, in which accommodation for about 30 designers is provided. From the model hall a corridor leads into a longitudinal corridor giving access to a number of large offices for heads of departments. The floor above the main floor is occupied by drawing offices, tracing offices and photo-printing rooms. About 150 draftsmen and 35 tracers are normally employed.

The floor below the main floor contains 30 offices occupied by overseers.

Dining accommodation for the whole staff, numbering about 400, is provided on the next lower floor. A kitchen, very fully equipped with electric cooking appliances, is also situated on this floor and the arrangements are such that about 300 luncheons can easily be served simultaneously.

The third floor below the main floor contains 14 offices occupied by yard officials, and below this is a mezzanine floor.

On the yard level the greater part of the floor space is occupied by the time office and the piece work office, but there are also a few offices for foremen and other rooms.

Platers' Shop

The most important of the shop buildings in the yard is undoubtedly the platers' shop, which is the largest of its kind in the country.

As shown on Fig. 6, the building is situated near the heads of the berths at the southern end of the yard and extends for nearly a quarter of a mile, terminating in front of the main office buildings.

Between the platers' shop and the embankment are the plate racks. Trucks containing plates are brought down the slope from the North Eastern Railway line by the yard locomotives, which haul them along the tracks under the gantry shown on Fig. 5. The trucks are here unloaded by two overhead traveling cranes, the plates being sorted according to

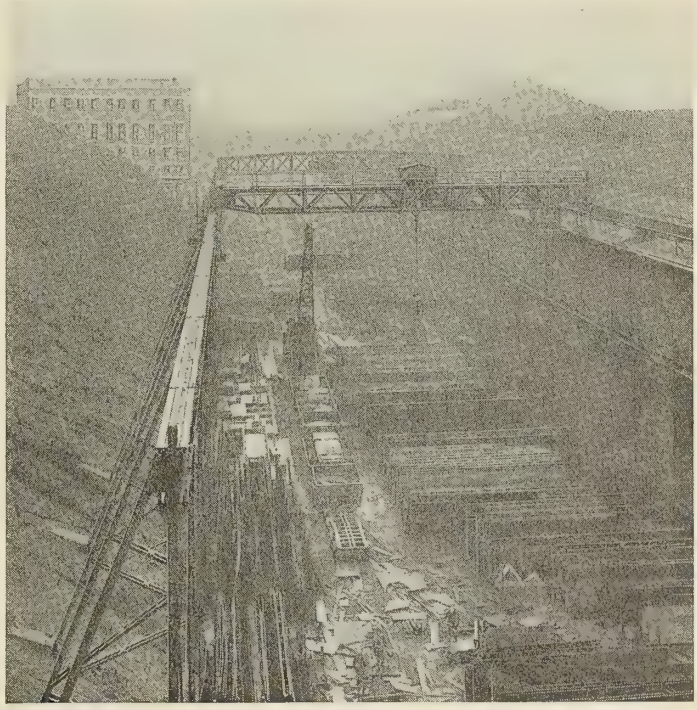


Fig. 5.—Plate Racks

size and thickness and placed in the appropriate racks. These cranes, each capable of lifting a load of 10 tons and of traveling laterally at the relatively high speed of 200 feet per minute, allow the largest plates to be easily and expeditiously handled. The crane rails, which are 48 feet 9 inches above the ground level, are supported on one side by the columns of the platers' shop and at the other side by a special steel gantry. The total length of the gantry is 1,120 feet and the span is 76 feet 6 inches between the centers of the crane rails. Two large pickling tanks are provided near the southern end of the plate racks.

Building

The platers' shop is a steel framed structure 1,200 feet in length and 150 feet wide, divided into three bays. The wing bays, it will be noticed, are each 52 feet in width, while the central bay is 46 feet wide. The shop is completely closed in on the sides with large sliding doors in convenient positions, so that work can be carried on in comfort in all weathers. The greater part of the roof and a considerable portion of the sides and ends are covered with glazing, the remainder being covered with corrugated sheets. This arrangement gives ample light in the daytime, as will be gathered from the interior views, and at night efficient illumination is provided by means of 2,000 candlepower half watt lamps.

Mold Loft

In an upper story at the northern end of the shop is situated the mold loft, Fig. 8, which extends over the eastern wing bay and the central bay. The floor dimensions of the mold loft are 320 feet in length by 98 feet wide, and the height to the spring of the roof trusses is 18 feet 9 inches, while in the center the height is 28 feet. The sides and ends are covered with corrugated sheets and glazing and the roof is partly glazed and partly covered with slates. Special attention was given to the construction of the floor in order to ensure a perfectly true surface, and for this reason specially selected Siberian pine was employed in planks 3 inches wide by 3 inches thick. A series of benches is arranged along the whole length of one side of the loft for making molds and templates, and the work is further facilitated by the employment of portable motor driven saws and other tools. The loft is well lighted both by day and by night, and in cold weather it is comfortably warmed by means of steam pipes.

Leading from the mold loft at the southern end, and extending over the central bay only, is a template storeroom measuring 35 feet by 80 feet. Access to the mold loft is obtained by a staircase 9 feet wide arranged in three flights having teak treads.

Cranes

The columns in the platers' shop are spaced 80 feet apart to give ample room for handling large plates. These columns carry longitudinal girders which support the crane tracks and the roof principals, the latter being spaced 20 feet apart.

There are three 10-ton electric, overhead, traveling cranes in each of the wing bays and two similar cranes in the central bay, the height of the crane rails above the floor level being 33 feet 4 inches in each case. These cranes are provided with independent motors for hoisting, traversing and longitudinal travel, the speed of the latter being 250 feet per minute. This speed, it may be mentioned, has been found as high as convenient in view of the fact that plates up to 45 feet in length have to be handled. Additional facilities for handling materials are provided by means of a large number of fixed hydraulic and hand operated cranes placed in convenient positions in proximity to the larger machine tools.

The usual method of handling plates is to lift them from the racks and bring them up to one of the sliding doors of the shop by means of one of the traveling cranes over the plate racks. They are then taken by one of the hydraulic cranes inside the shop to the straightening rolls, if required, and thence by means of the overhead cranes in the shop to the various machine tools. When the necessary operations are completed the plates are placed on railway trucks and hauled down to the berths by steam locomotives.

Arrangement

The layout of the shop is shown in Fig. 7. It will be noticed that the punching and shearing machines and other tools are arranged with ample space between them so that long plates can be operated on in one machine without interfering with the work at another tool. They are also, of course, arranged so that the various operations can be carried out in an efficient sequence involving the minimum possible amount of handling. In general, the heavier work is done at the northern end of the shop, the whole of the southern end being used for work of a lighter character. The central portion of the shop, as will be noted from Figs. 7 and 10, is free from machine tools, this portion being used for the laying out of decks and bulkheads.

Tool Equipment

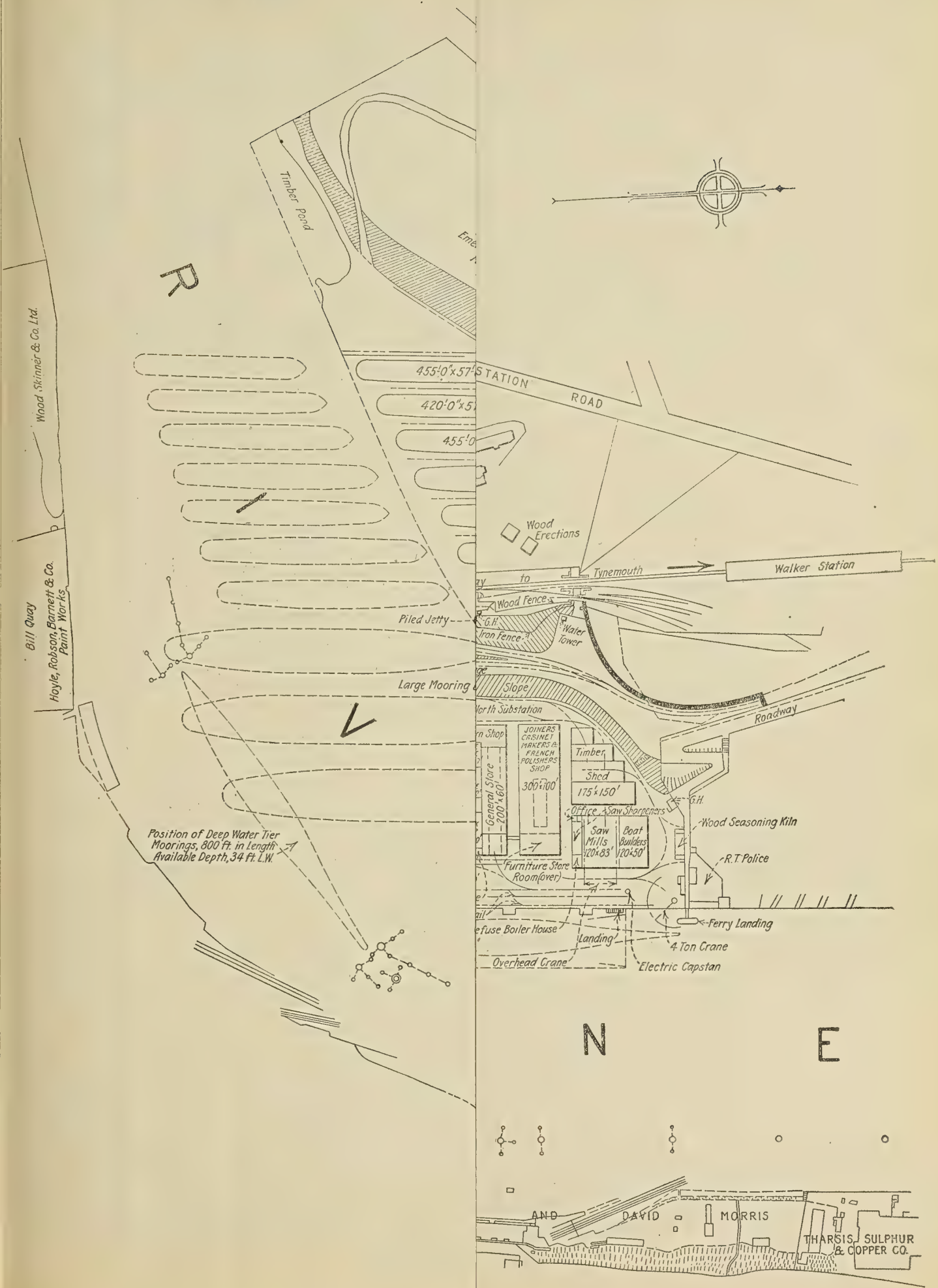
The tool equipment of the shop includes a variety of punching and shearing machines disposed as shown in Fig. 7. They are designed to punch holes up to 1½ inches in diameter through mild steel plates 1½ inches in thickness or up to 1¼ inches in diameter through high tensile steel up to 1¼ inches thick. The smaller machines are capable of working on mild steel plates up to 1 inch in thickness.

One of the machines is fitted with a manhole punch capable of cutting manholes up to 23 inches by 15 inches through ¾-inch plates. All the large punching and shearing machines are provided with 8-ton cranes of 23-foot rake, while the smaller machines have 5-ton cranes of 20-foot rake attached. Plate straightening rolls, or mangles as they are termed, are provided of various makes and capacities, the largest a four roller machine capable of dealing with plates up to 12 feet in width and up to 2 inches in thickness. Each mangle is served by a hydraulic crane of suitable capacity—in fact, all machines in which work has to be supported during the machining process are fitted with self-contained cranes.

In addition to the above-mentioned tools there are a number of radial drills, plate edge planers, joggling machines, etc., which form part of the equipment of all modern platers' shops and therefore call for no special comment. There are, however, a number of heavy tools which are worthy of more detailed treatment.

One of the most important tools is the large plate bending rolls situated near the center of the shop. This machine has a clear width of 41 feet 6 inches between the housings and is capable of working high tensile steel plates up to 41 feet in length and up to 2 inches in thickness. The three rollers are of forged steel, the upper one being 21 inches in diameter and the two lower ones 16½ inches in diameter. Each of the rollers is supported by three sets of roller bearings in addition to the journals at the ends, the bearings being mounted on brackets bolted onto heavy steel plate girders, as shown in Fig. 12. The upper roller and its supporting girder can be adjusted vertically, to alter the radius of curvature of the work, by means of screws operated by two 35-horsepower electric motors and worm gearing, and the lower rollers are fitted with sliding bushes so that they can be adjusted laterally to suit plates of different thicknesses. The lower rollers are both driven by a single electric motor of 260 horsepower by means of spur gearing. All the gearing, with the exception of the two large wheels keyed onto the roller journals and the pinions which gear with them, is of cast steel with machine cut teeth.

The main driving motor, which runs at 585 revolutions per minute, is of the totally enclosed, slip-ring type for three


Timber Pond
R
I
V
E
R
Wood Skinner & Co. Ltd.
Bill Quay
Hoyle, Robson, Barnett & Co. Paint Works
455'0"x57'
STATION ROAD
420'0"x5
455'0
Wood Erections
Tynemouth
to
Walker Station
Wood Fence
G.H.
Iron Fence
Water Tower
Piled Jetty
Large Mooring
Slope
North Substation
Roadway
JOINERS CABINET MAKERS & FRENCH POLISHERS SHOP 300'x100'
Timber Shed 175'x150'
General Store 200'x60'
Office
Saw Sharpeners
Saw Mills 120'x83'
Boat Builders 120'x50'
G.H.
Wood Seasoning Kiln
R.T. Police
Furniture Store Room (over)
Ferry Landing
Refuse Boiler House
Landing
4 Ton Crane
Overhead Crane
Electric Capstan
Position of Deep Water Tier Moorings, 800 ft. in Length Available Depth, 34 ft. L.W.
N
E
AND
DAVID
MORRIS
THARSIS SULPHUR & COPPER CO.

ONE OF ENGLAND'S LARGEST SHIPYARDS

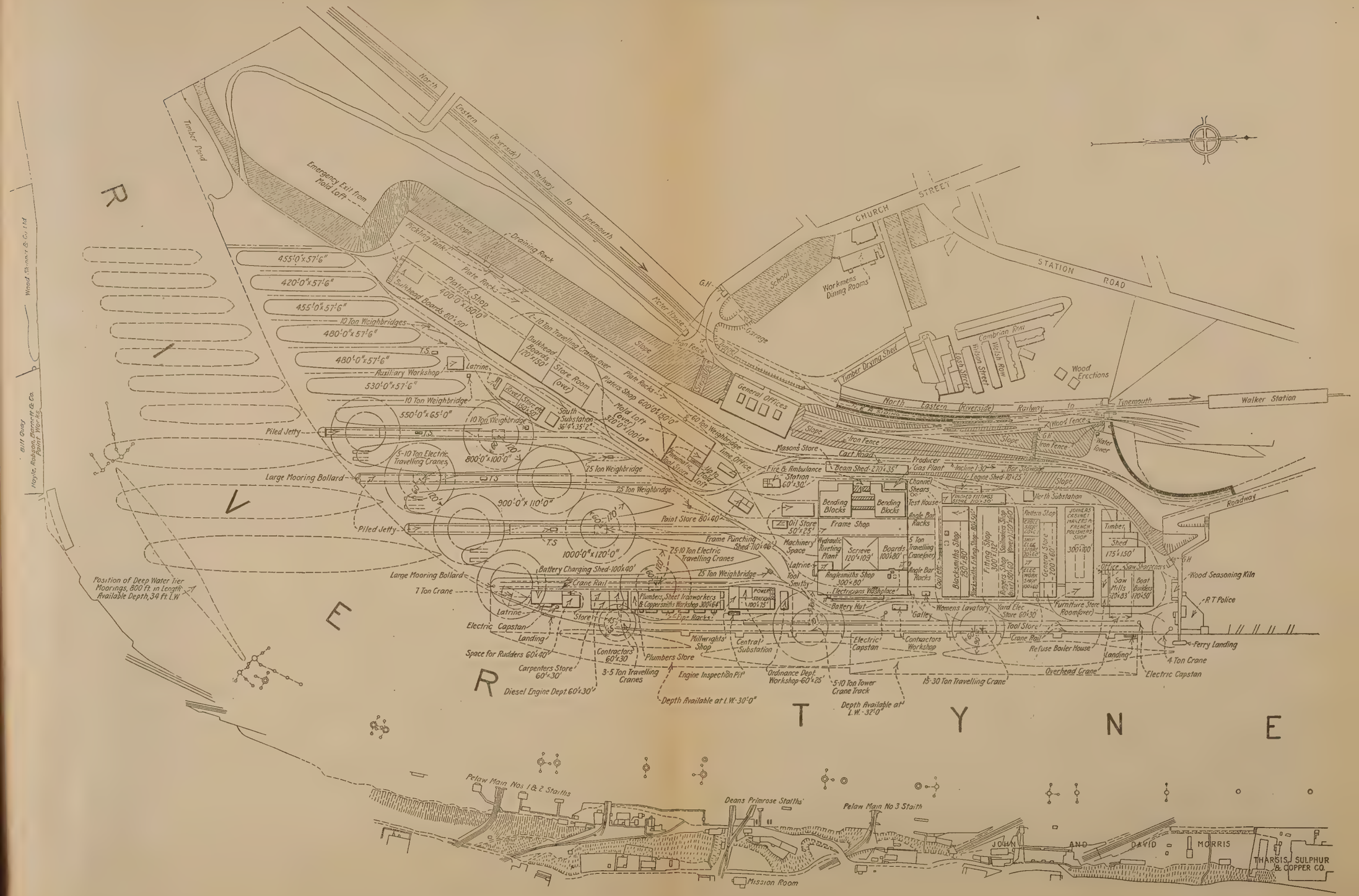
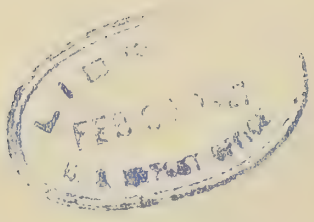


Fig. 6.—General Layout of Armstrong Yard of Sir W. G. Armstrong, Whitworth & Company, at Newcastle-on-Tyne



PYARDS

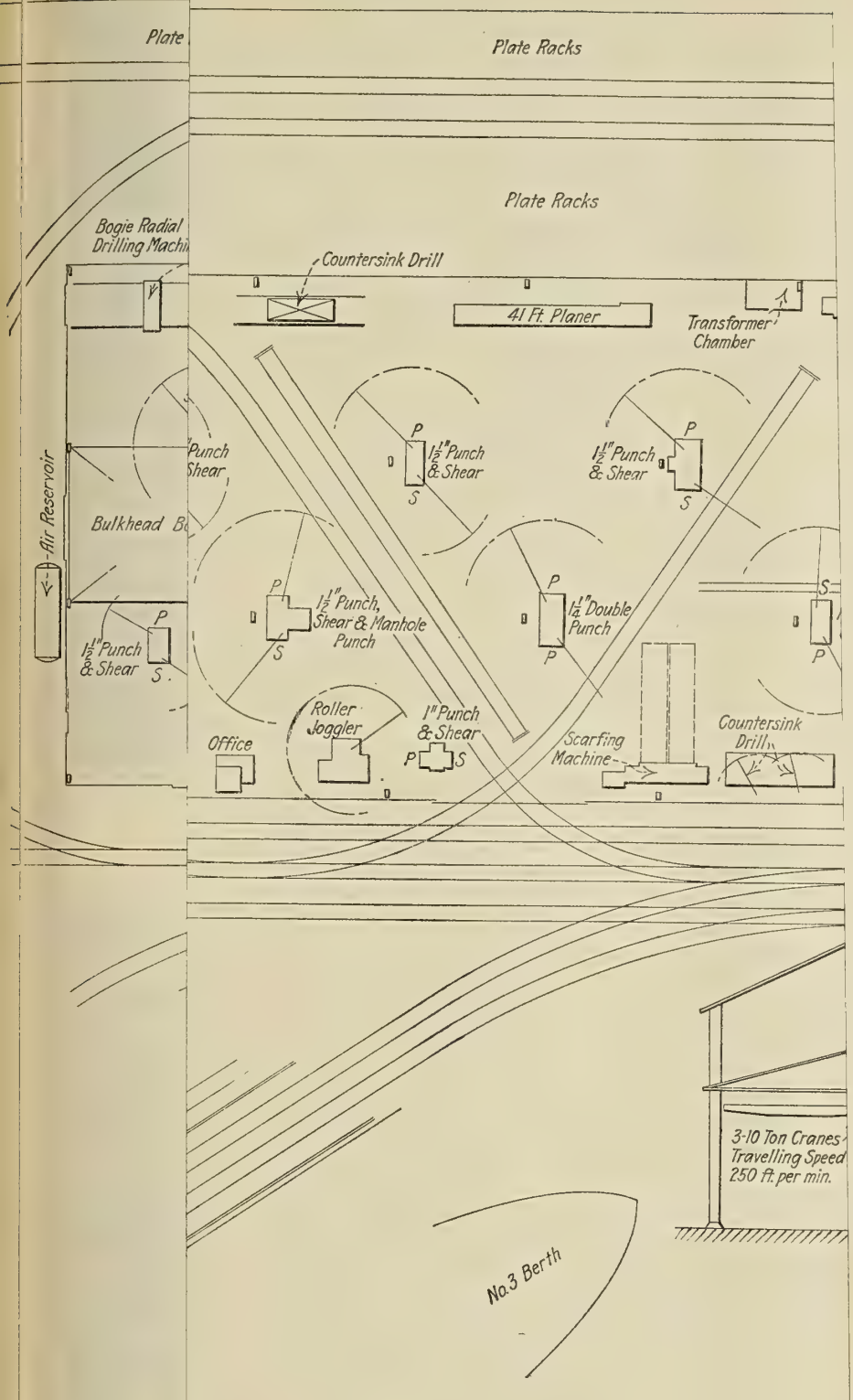


Plate
Plate Racks
Plate Racks
Bogie Radial Drilling Machi
Countersink Drill
41 Ft. Planer
Transformer Chamber
Punch Shear
Bulkhead Be
Air Reservoir
1½" Punch & Shear
1½" Punch & Shear
1½" Punch & Shear
1½" Punch, Shear & Manhole Punch
1½" Double Punch
1" Punch & Shear
Roller Joggler
Office
Scarfing Machine
Countersink Drill
3-10 Ton Cranes Travelling Speed 250 ft. per min.
No. 3 Berth

ONE OF ENGLAND'S LARGEST SHIPYARDS

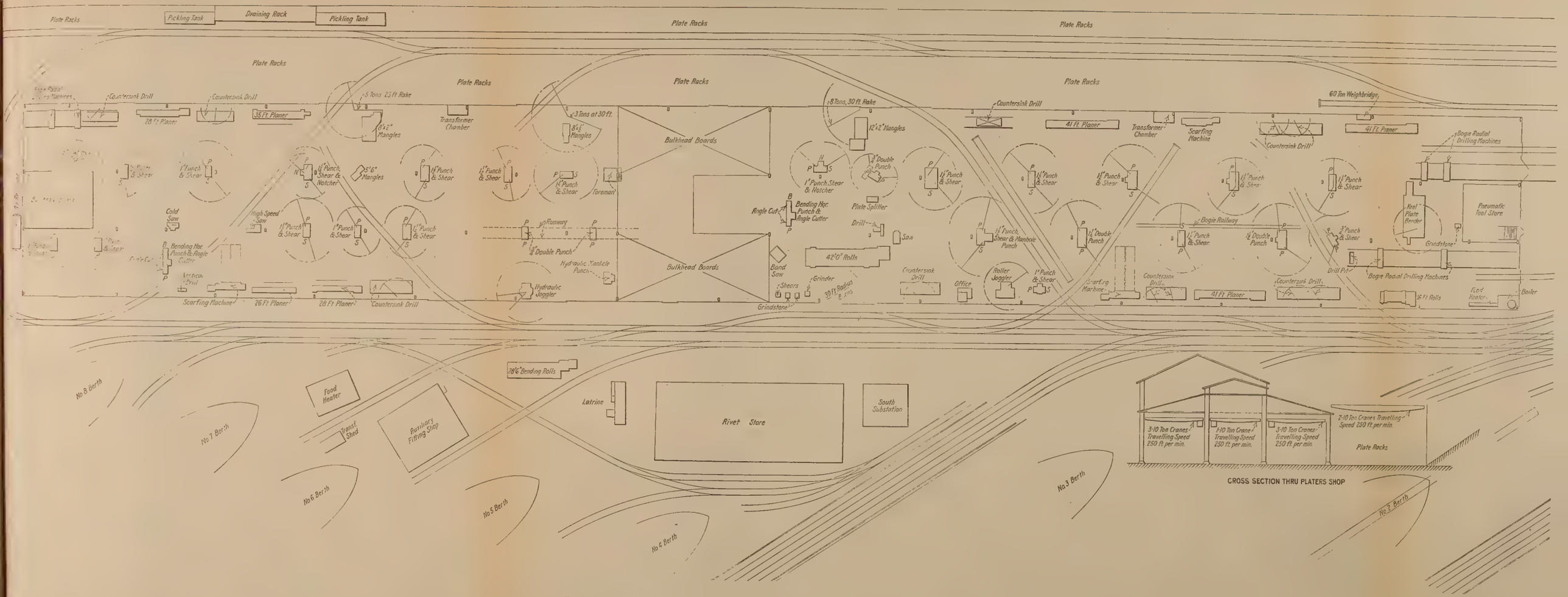


Fig. 7.—Layout of Platers' Shop at Armstrong Yard of Sir W. G. Armstrong, Whitworth & Company, Newcastle-on-Tyne

Fig. 8.—Mold Loft

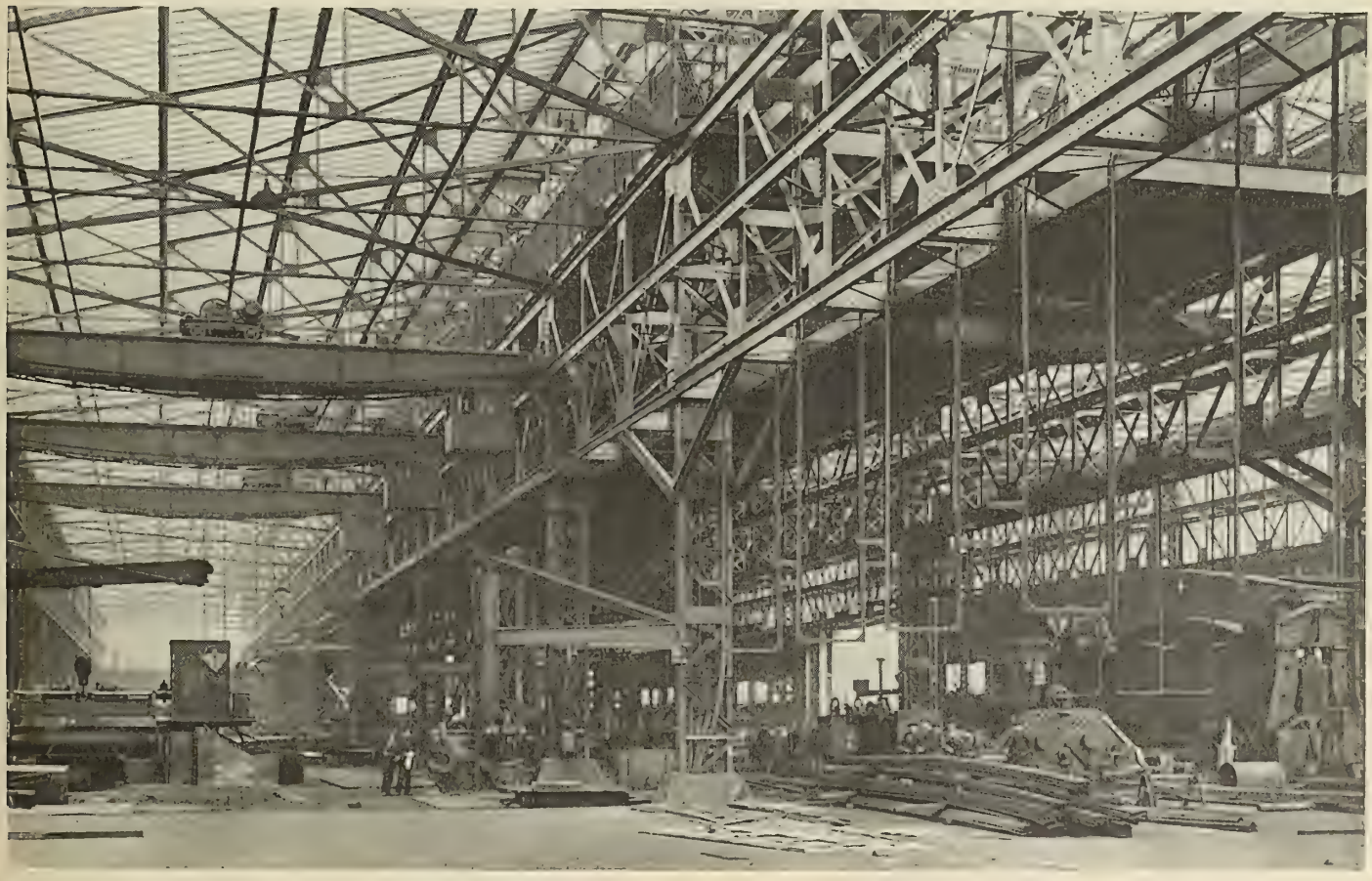


Fig. 9.—Platers' Shop, Looking North

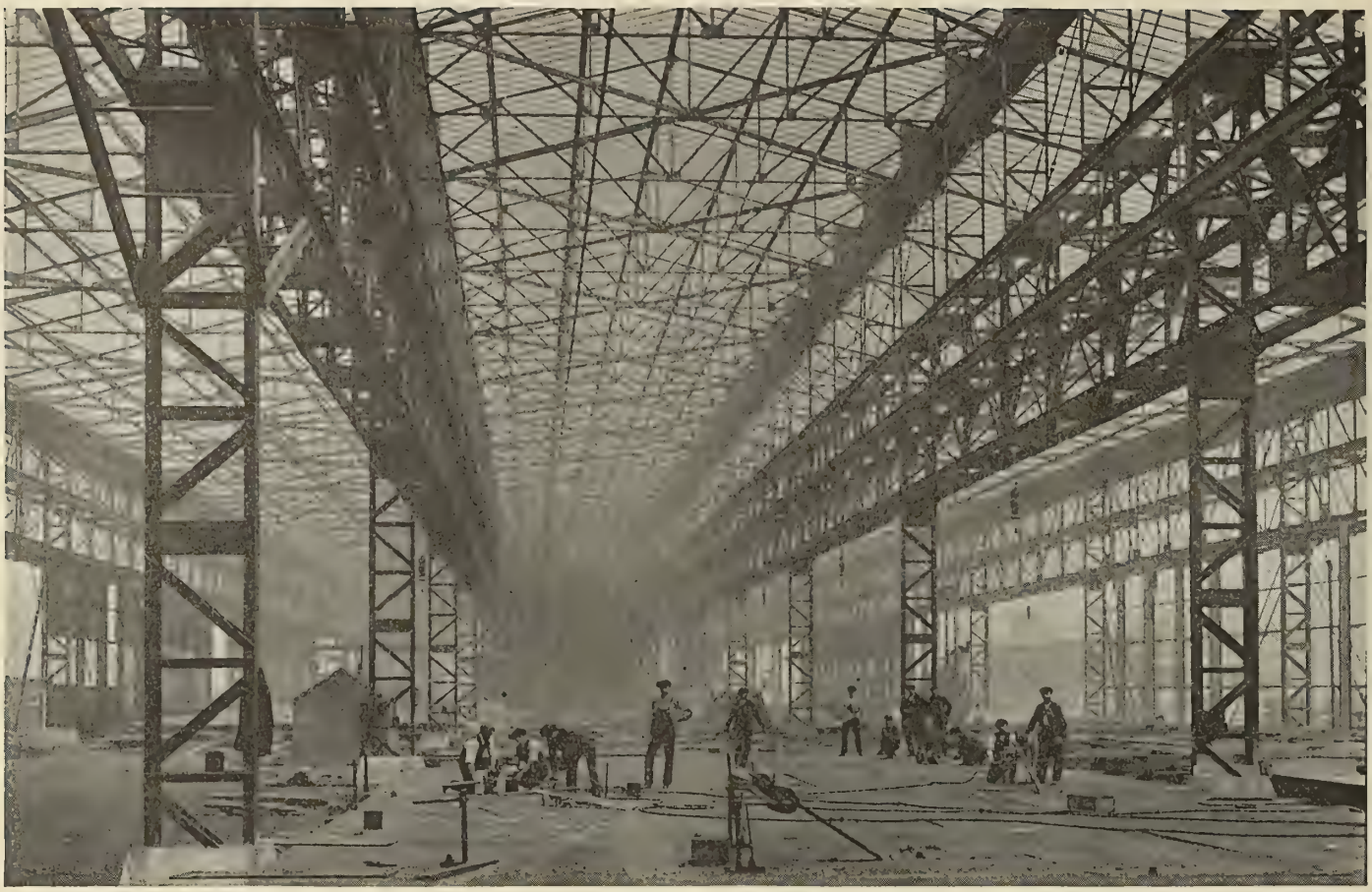


Fig. 10.—Central Portion of Platers' Shop, Used for Laying Out Decks and Bulkheads

Fig. 11.—Platers' Shop, East Bay

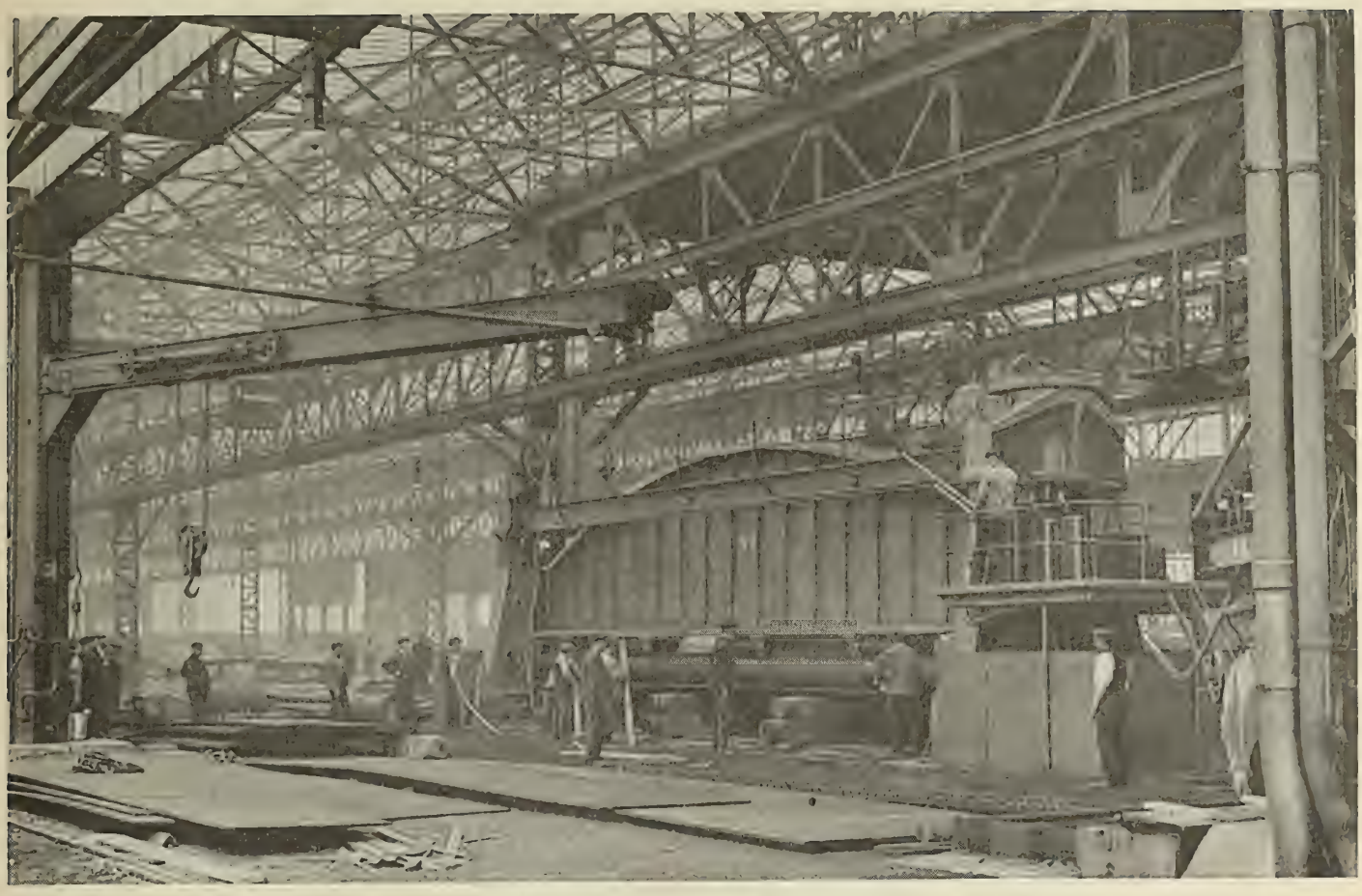


Fig. 12.—Large Bending Rolls in Platers' Shop

Fig. 13.—Platers' Shop, West Bay

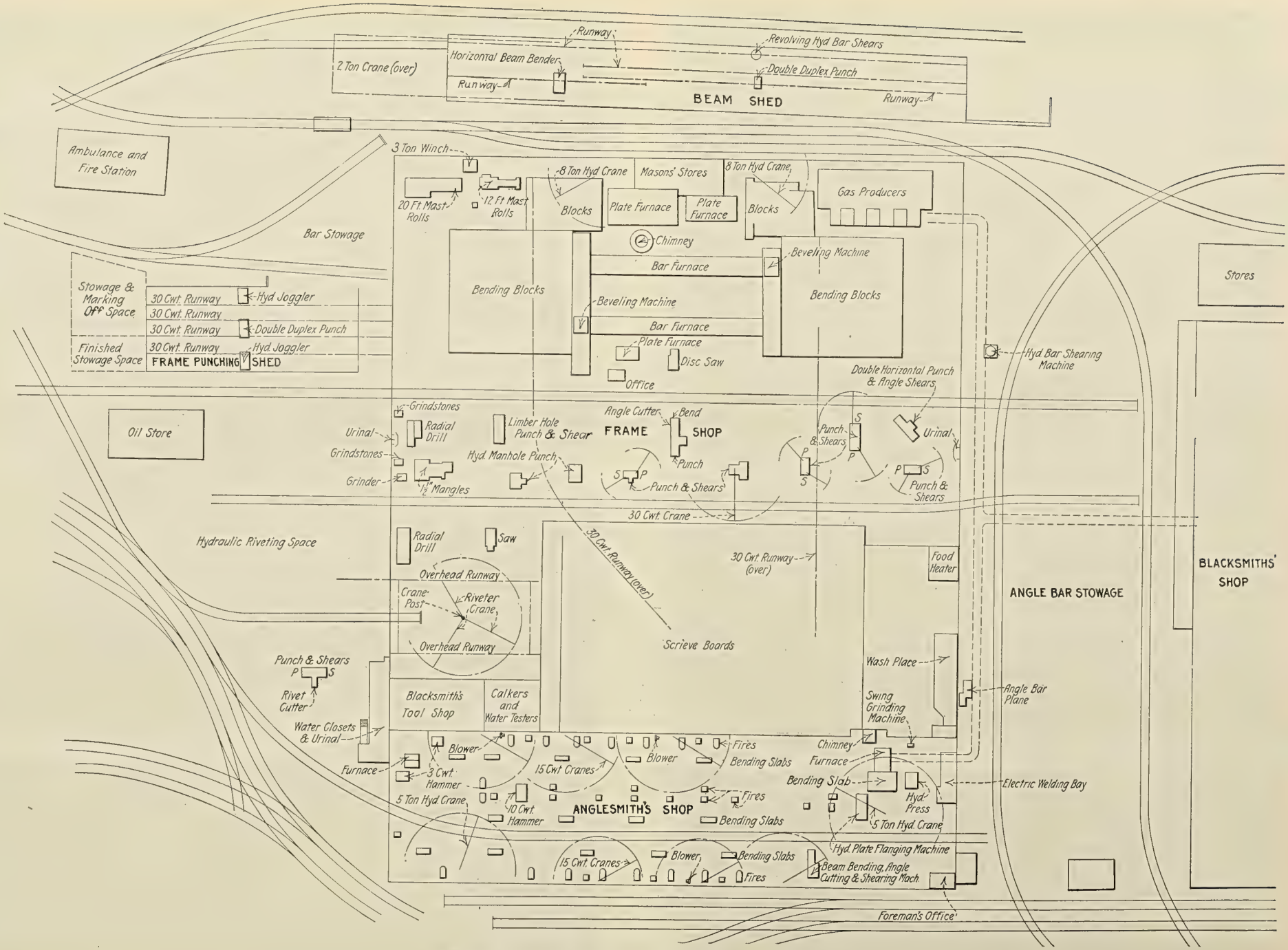


Fig. 14.—General Layout of Frame and Anglesmiths' Shops

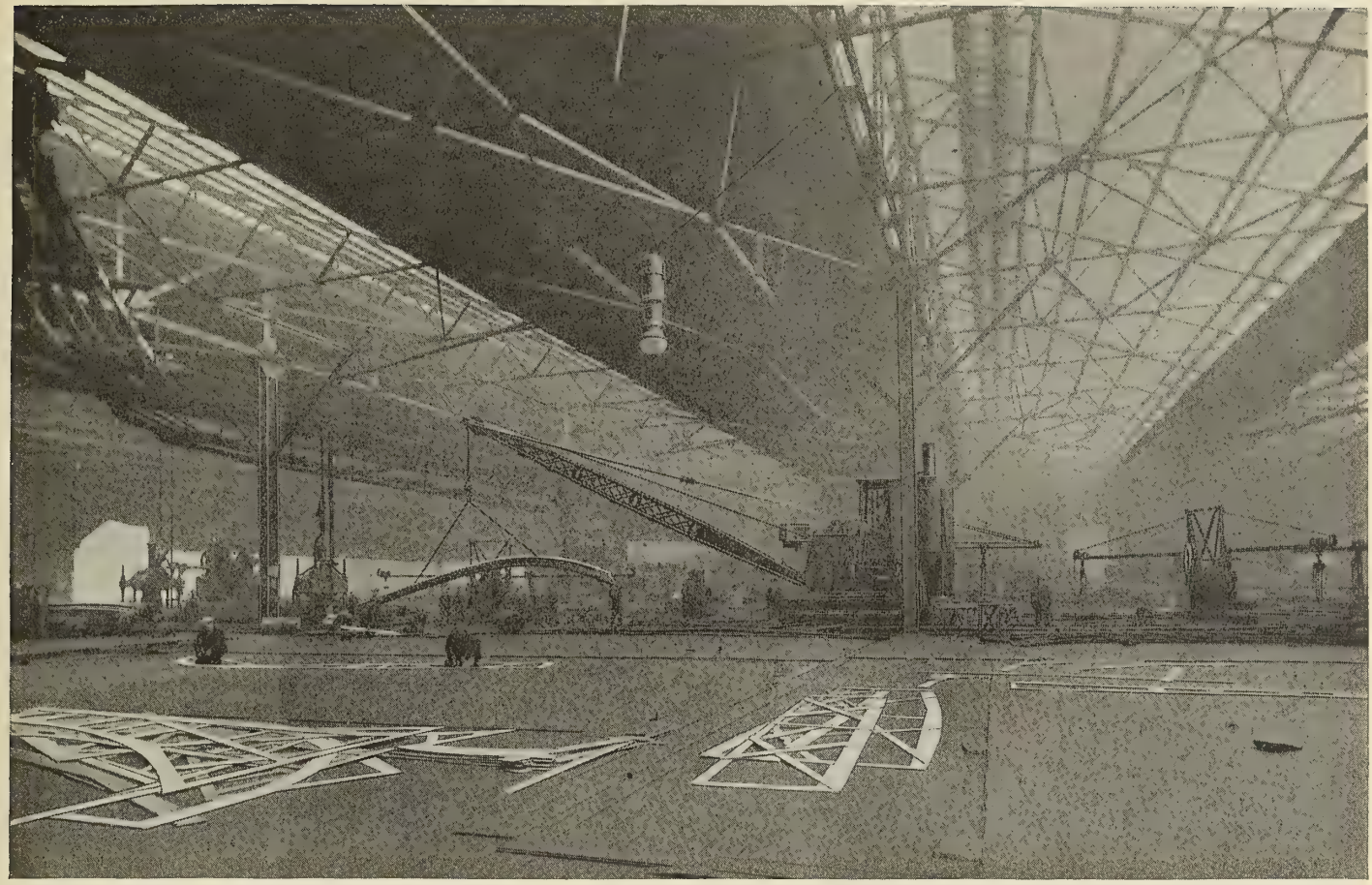


Fig. 15.—Frame Shop, General View Showing Scrieve Boards

phase current at 440 volts and 40 cycles. It is fitted with an electro-magnetic brake and is operated by a horizontal oil-immersed, drum type controller fitted with a hand wheel. The two smaller motors for raising and lowering the upper roller are of the same type but run at 765 revolutions per minute and they are operated by the vertical drum type controllers mounted on a platform on the right hand side of the machine. The three motors are of Messrs. Armstrong's own manufacture.

The hydraulic crane serving this machine was supplied by the engine works department of the firm at Elswick. It is capable of lifting a load of 8 tons a height of 13 feet at a maximum radius of 30 feet and a minimum radius of 10 feet. The lifting motion is effected by a hydraulic cylinder and ram with 4 to 1 multipliying gear, and the slewing motion by a pair of cylinders with 2 to 1 multiplying gear. One of the two cylinders with 4 to 1 gear is also employed for racking the load along the jib.

At each end of the shop are sets of high speed radial drills of a special design mounted on a bridge which runs on rails. The plates to be drilled are laid on bearers between the rails and one or more of the drills is traversed along the rails as the work of drilling proceeds.

Frame Shop

Most of the remaining buildings in the yard are situated at the northern end and are arranged with their greatest lengths at right angles to the fitting out dock. The largest and most important of these is a steel framed structure measuring 380 feet long, 300 feet wide and 30 feet high to the eaves, and comprising the frame shop and anglesmiths' shop. The latter runs across the whole width of the building at the eastern end and is itself 80 feet wide, so that the frame shop is actually 300 feet square. Fig. 14 shows the arrangement of the tools, cranes and other appliances in both shops.

Anglesmith Shop

The anglesmiths' shop contains two electrically driven pneumatic power hammers with a coal fired furnace between them; these are mostly used for drawing packings and similar work. There are a number of pot fires and anvils for anglesmiths' work arranged in convenient groups along the center and down one side of the shop. Blast is provided by three electrically driven fans, which are designed to give an air pressure equivalent to a 22-inch column of water and deliver air to the fires through underground ducts. These are arranged so that air can be supplied to any one of the groups of fires independently of the other groups.

At the northern end of the shop is a gas fired plate furnace, 10 feet 6 inches long by 6 feet wide, provided with bending blocks in front. Near this furnace is a hydraulic plate flanging machine having two 60-ton vertical overhead rams and a smaller horizontal ram for squaring up flanges, etc. The width of the gap from the centerline of the vertical rams to the body of the machine is 4 feet, and there is also a 4-foot clearance between the table of the machine and the bottoms of the rams when the latter are at the upper end of their stroke.

An 80-ton hydraulic press for flanging and pressing work is also located near the plate furnace. The large flanging machine is served by a 5-ton hydraulic crane and the crane equipment of the shop also includes another 5-ton hydraulic crane, used for handling heavy work from railway wagons, and a number of 10 hundredweight hand cranes serving the fires. One of these cranes is used in conjunction with an angle bending, cutting and straightening machine which is located as shown on Fig. 14.

A considerable amount of electric and acetylene welding is carried on in this shop and a special bay is partitioned off at the northern end for this purpose, so that the autogenous welding practically forms a department by itself.

Scrieve Boards

A considerable portion of the floor space in the frame shop, 22,000 square feet to be exact, is occupied by the scrieve boards. On these boards the frames are laid out to full size for making the templates from which the set irons, or lines, are laid out on the bending blocks so that the frames may be bent to the correct form. Fig. 14 shows the relative positions of the scrieve boards, furnaces and bending blocks.

Furnaces

For heating the angle bars from which the frames are formed, two double ended bar furnaces, each 90 feet long by 4 feet wide by 3 feet 6 inches deep, are provided, and there are also three plate furnaces, the largest of which will take a plate 36 feet long by 13 feet wide. These furnaces, it should be explained, are mainly employed for heating the plates for the stems and sterns of ships, but they also deal with any other plates which require furnacing. The doors of the large plate furnaces are fitted with hydraulic gear for opening and closing, and electric winches are provided for hauling the plates from these furnaces and the bars from the

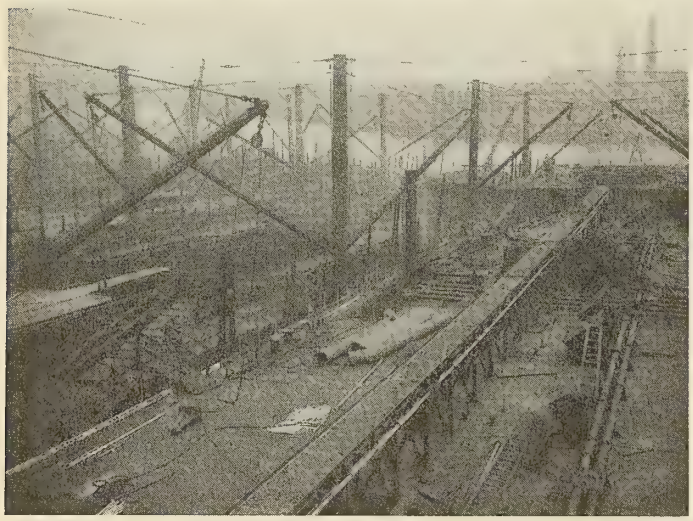


Fig. 16.—View Across Smaller Building Berths

bar furnaces. All the furnaces are gas fired, gas being supplied by four producers each capable of gasifying 10 hundredweight of coal a day. Steam for the producers is supplied by two vertical boilers.

Beveling Machine

A beveling machine is provided at each end of the bar furnaces for opening the angles of the frame bars so that the flanges conform with the line of the shell plating of the ship. These machines, capable of beveling angles up to 10 inches by 5 inches by 1 inch thick, are mounted on rails so that they can be moved into line with either furnace as required. The heated bars, after passing through the beveling machine, are placed on the bending blocks, clamped at one end by iron dogs and bent to the curve of the set iron by means of portable hydraulic frame setters. When cold, the frames are tested against the curves set out on the scrieve board, and, if necessary, returned to the bending blocks for adjustment.

Machine Equipment

The machinery equipment of the shop includes a number of punching and shearing machines, angle cutters, manhole punches, drills, saws, etc., most of which are arranged in the center of the shop as shown on Fig. 14, but two sets of plate bending rolls for forming masts and other tubular work of this class are situated in the southwest corner near the plate furnaces. A portion of the shop alongside the scrieve boards is occupied by a hydraulic riveting plant, the arrangement of which is similar to that at the heads of the building berths. There are also a tool smithy and an electric welding bay in the shop. Two of the plate furnaces are served respectively by 8-ton and 5-ton hydraulic cranes of Messrs. Armstrong's own design and construction and which are similar in every way to those already mentioned when dealing with the platers' shop. Overhead runways of 30 hundredweight capacity are provided for conveying frames between the bending blocks and scrieve boards, but work is also handled by the yard locomotive cranes. The angles required in the frame shop are stored in angle racks on the northern side of the building, the racks being served by a 5-ton electric overhead crane of 120 feet span. A hydraulic angle bar shearing machine and a planing machine for angles are provided in convenient positions near the racks.

Sequence of Work

The general sequence of work through the frame shop is as follows: The bars are taken from the racks and marked off for punching, and after punching and joggling are taken to the furnaces; then, after bending on the bending blocks, they are conveyed to the scrieve boards for trial and, if correct, the ends are faired and the frames delivered onto the berths by rail.

Frame Punching Shop

Additional facilities for frame work are provided in the frame punching shop. This building, which, as shown on Fig. 6, is situated at the southern side of the frame shop, measures 130 feet by 45 feet and is specially arranged for punching and joggling both frames and deck beams. There are three machines in the shop—a double ended duplex punch and two Lambies' patent jogglers. The machines are arranged so that two sets of men can work independently of each other, and this allows four frame furnaces to be kept going continuously. Overhead runways will be used for handling the frames in this shop and also for conveying them to the frame shop in which they will be bent and tried on the scrieve boards as mentioned above.

Deck Beam Shop

At the western end of the frame shop, and in close proximity to the railway tracks on which materials are brought into the yard, is a long, narrow building used for the preparation of deck beams. This building is actually 270 feet long by 35 feet wide. The rolled steel sections from which the beams are formed are unloaded from the railway trucks and passed into the shop at the northern end by means of locomotive cranes. They are then marked off, punched and beveled, or bent, as required, and delivered directly onto the berths from the other end of the shop. The building is equipped with a duplex punching machine and a hydraulic cropper, but the most interesting tool in the shop is the Arthur's patent bending machine.

This machine is capable of admitting beams up to 15 inches in depth and is sufficiently powerful to form the usual deck camber of ¼ inch per foot on bulb angles, bulb tees, channels, zees and other sections up to 13 inches deep. Lighter sections can, if required, be bent to a much smaller radius; for example, bulb angles up to 9 inches deep can be bent cold to a radius of 6 feet, and 6-inch bulb angles can be bent to a 3-foot 6-inch radius.

(*To be continued.*)

An Informational Service Concerned With Metals and Alloys.—An Alloys Research Association is being formed with the aid of the Research Extension Division of the National Research Council, Washington, D. C., with an Alloys Informational Service as the first step. This is to be co-operative on the part of those interested in metals and their alloys.

Fig. 1.—S. S. *Samaria,* Built by Cammell Laird & Company, Ltd., Birkenhead. From an Original by A. J. W. Burgess, R. I.

The New Cunarder Samaria

Transatlantic Passenger Steamer Built by Cammell Laird and Company, Ltd.

THE *Samaria,* launched from the shipbuilding yard of Messrs. Cammell Laird & Company, Ltd., Birkenhead, on November 27, will in her construction and fitting-out represent the latest development of the art of shipbuilding. In both respects she will possess features which set up a new departure in Atlantic travel from the point of view of the comfort and convenience of passengers.

The Old and the New

The launch of the *Samaria* from this famous yard, takes us back to 1882, for the only previous association between the present builders and the company from the point of view of actually building a ship. It was in that year that Messrs. Laird Brothers built the *Cephalonia,* an iron screw steamer which proved such a successful unit of the company's Boston service. The *Cephalonia* had a length of 440 feet 6 inches, breadth of 46 feet 3 inches and a depth of 36 feet. Her gross tonnage totalled 5,517, and her compound engines developed 4,000 indicated horsepower and a sea speed of 13 knots. These dimensions, together with the figures of the old *Samaria,* built in 1868 (length 311 feet, beam 39 feet, depth 28 feet 3 inches, 2,574 gross tonnage, horsepower 1,590 and speed 11 knots) make an interesting comparison with those of the ship under review and reveal something of the progress made during the last fifty years in ship construction.

Principal Dimensions of New *Samaria*

Length overall	623 feet 9 inches
Length between perpendiculars	600 feet
Breadth molded	73 feet 6 inches
Depth molded to shelter deck	45 feet
Gross tonnage	21,000
Sea speed	16 knots

Accommodation for nearly 2,600 passengers, made up of 336 first class, 340 second class and 1,504 third class.

New Features

In the matter of passenger accommodation the *Samaria* will include features which hitherto have not been introduced in a vessel of her size. Garden lounges for the sole use of saloon passengers and a verandah café for second-class passengers set up a high level of luxury which will appeal to the Atlantic traveler.

The various public rooms have been so designed that they all lead from the main staircase, which forms itself into an imposing central hall. The great oval lounge, with its delicate Chinese designs, will, undoubtedly, prove a favorite resort of the *Samaria's* saloon passengers. The drawing and writing room also will maintain the high standard of cosiness attained in the *Samaria's* design. These public rooms will have small subsidiary rooms or alcoves which, while forming part of the general *ensemble,* will maintain a certain sense of privacy. A feature of the dining saloon will be the separate tables for two and four persons or small parties. This is applicable both to first-class and second-class passengers. In the *Samaria,* too, it will be found that a successful effort has been made to provide third-class passengers with every degree of comfort. For all classes of passengers the construction and design of the *Samaria* ensure considerable space, both open and covered, for promenading, exercise and various games.

Passenger Accommodation

The public rooms will include:

Saloon—
- Dining Room.
- Lounge.
- Smoking Room.
- Drawing and Writing Room.
- Garden Lounges.

Second Class—
- Dining Room.
- Drawing Room.
- Smoking Room.
- Verandah Café.

Third Class—
- Dining Rooms.
- General Room.
- Smoking Room.

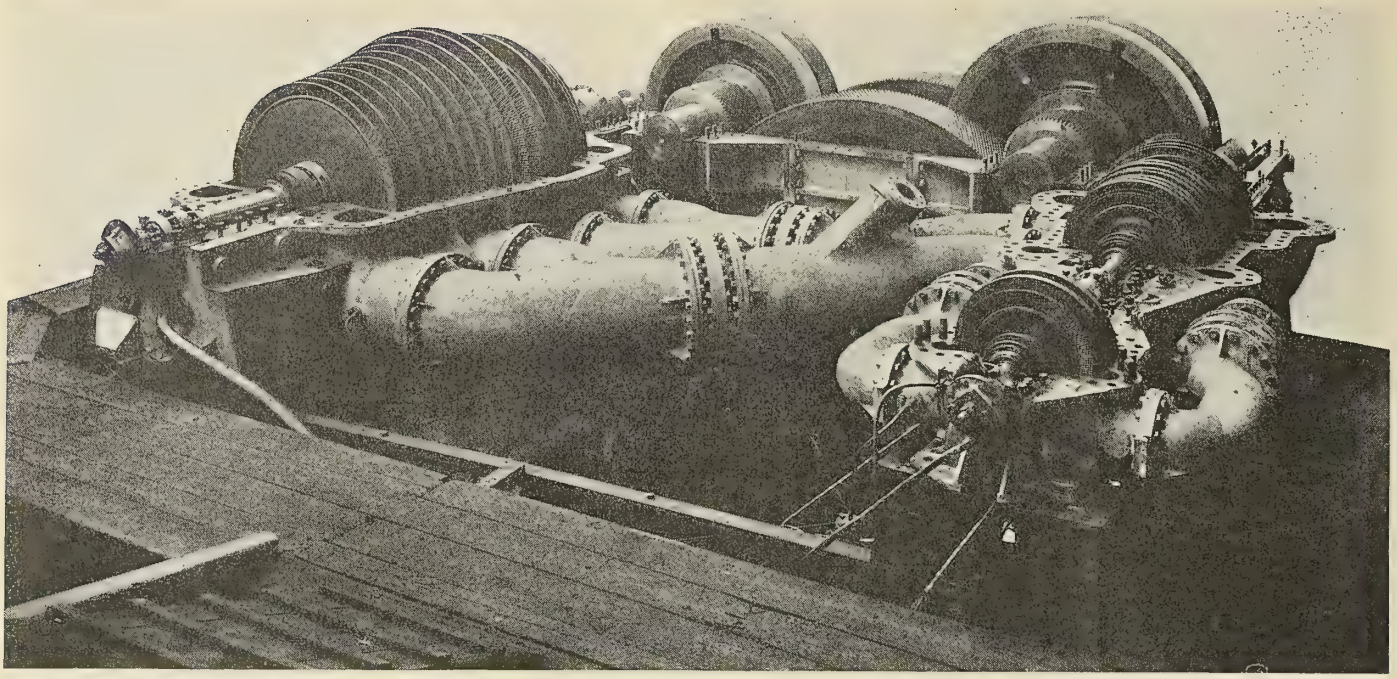


Fig. 2.—Turbines and Reduction Gearing, Upper Casing Removed

The extensive passenger accommodation of the *Samaria* will extend over seven decks. The refinement with which the scheme of decoration is to be carried out to the smallest detail is in keeping with that high standard which has caused Cunard liners to be regarded as models of artistic taste. In a word, the interior of the *Samaria* will be that of a new Cunard floating hotel, and her exterior that of a staunch and steady ocean liner—a worthy successor to a long line of vessels whose names have been world-famous.

Turbines

Each of the two sets consists of one high pressure and one intermediate pressure turbine driving in tandem one pinion and one low pressure turbine driving the other pinion of the first reduction gearing and then through the second reduction gearing to the main shaft. Compound astern turbines are incorporated in the exhaust casings of the intermediate and low pressure ahead turbines. The high pressure turbines are supplied with superheated steam and the low pressure turbine exhausts to the main condensers, which are suspended directly below the turbines and are designed for a high vacuum. The turbine must, of course, revolve at a comparatively high speed in order to operate most economically, while the rate of revolution of the propeller should be considerably less. This result is achieved by the double-reduction gearing.

Oil Fuel

The *Samaria,* too, is the largest liner to be designed and built on the Mersey for the burning of oil fuel. Not only does a certain weight of oil have a greater heating value than a

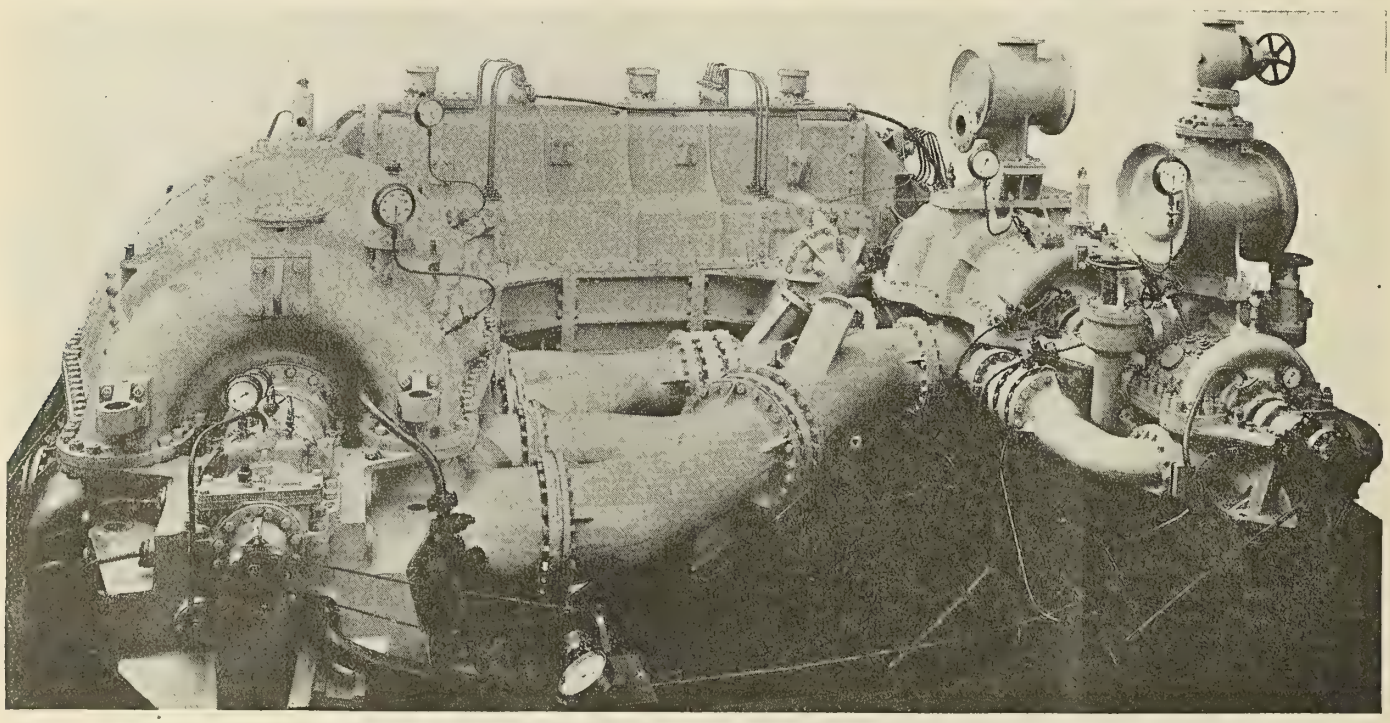


Fig. 3.—Turbines and Reduction Gearing Assembled

similar weight of coal, but it occupies less space and requires infinitely less attention. In addition, bunkering can be accomplished more simply and rapidly, the wear and tear on the boilers is less, and as the oil fuel can be carried in the ship's double bottom, unusually spacious passenger accommodation and cargo holds are available.

Propeller Revolutions

In the case of the *Samaria* the propeller revolutions at full power will be about 90 per minute, corresponding to a speed of 2,750 revolutions per minute for the high and intermediate pressure turbines and 1,770 revolutions per minute for the low pressure turbines. They will develop 13,500 shaft horsepower, the two shafts driving the ship at 16 knots.

Electro-Hydraulic Auxiliary Machinery

The auxiliary machinery of the *Samaria* provides yet another example of the very modern improvements and features which will be found in her construction. The arrangements for the rapid and efficient handling of cargo are of a very complete nature. Numerous steel derricks and cargo spaces are placed at each hatch and electro-hydraulic variable speed gear winches are fitted throughout. The boat winches, capstan, windlass, warping winches and steering gear are all operated on the electro-hydraulic principle. There is thus a complete absence of big steam pipes running fore and aft in the ship interfering with promenade and accommodation space.

Two large sets of turbo-driven generators are to be installed to supply power to the electrical appliances of the ship and an oil driven emergency dynamo is installed on "B" deck.

Gyroscopic Compasses

A wireless equipment of great power is installed. Gyroscopic compasses are provided for navigating the ship as well as patent standard compasses. The gyro is a remarkable invention. While the master compass is fixed on one of the decks below, there will be three separate controlled compasses on the bridge. Its great advantage is that unlike other compasses it is independent of magnetic north and requires no adjustment.

Lifeboat accommodation for all persons on board is provided and Welin's patent quadrant davits are fitted, together with electro-hydraulic boat winches, for the rapid handling of the boats.

Other Appliances

The *Samaria* will pass the survey of the British Board of Trade and American authorities in all respects as a passenger steamer, and the watertight subdivision of her hull and details of her construction and equipment are in accordance with the International Convention Regulations for safety of life at sea. The doors in the bulkheads are operated by hand gearing of the Stone Lloyd hydraulic system, and above the bulkhead deck screen bulkheads are fitted to prevent the spread of fire.

The system of forced lubrication installed ensures a thorough supply of oil to the mechanical gearing and bearings and has been devised to meet the most modern requirements. The main thrust blocks which are of the Michell type are also supplied with forced lubrication.

The propellers have cast steel bosses with separate blades of manganese bronze. All the steel forgings for the turbine rotors, gearing and line shafting have been supplied by the Sheffield works of Messrs. Cammell Laird and Company, Ltd.

There are three double ended and three single ended cylindrical marine type boilers supplying steam at a pressure of 220 pounds per square inch, and fitted for burning oil fuel on the Howden-Wallsend system. The double ended boilers each have eight furnaces and the single ended boilers four; Schmidt's smoke tube type of superheaters are fitted. The installation is supplied with high class auxiliary machinery, including Messrs. Weir's latest closed feed system for dealing with the feed water, turbo-driven main feed pump and turbo-driven main circulating pumps. A number of motor driven pumps for general purposes are also fitted.

The New Shipbuilding Programme

The Cunard Line suffered heavy losses through the nefarious German submarine warfare. Not less than fifteen vessels of the Cunard fleet were lost, equal to 56 percent of the total tonnage. No time has been lost by the company in repairing this deficit, and today thirteen new ships, representing nearly a quarter of a million tons, are under construction. They all represent in their design, both structural and fitting out, the very latest improvements of naval architecture. They are all to be built to burn oil fuel.

Two of these steamers will be in commission in January and February respectively. The *Albania* (12,000 tons), which will carry cabin passengers only, after making her maiden voyage in the Liverpool-Canada-New York service, will return direct to London and take her place in this popular Cunard passenger service from the Metropolis to Canada and New York. The other ship, the *Scythia* (21,000 tons), a sister ship of the *Samaria,* will take her place in the Cunard Liverpool-Canada-New York service, calling at Queenstown.

The *Tyrrhenia* (16,000 tons) is expected to take her place in the company's passenger service early next summer. The remaining vessels will take the water in the near future. They are the *Franconia, Laconia* and *Servia* (each 600 feet long); the *Alaunia, Andania, Aurania, Ausonia, Ascania, Antonia,* all of which will be 520 feet in length. These vessels, with two exceptions, take the names of former vessels of the Cunard fleet and include some which distinguished themselves on war service and were lost through enemy action.

Weights of Various Plumbing Fixtures

	Weight
17 by 19-inch enameled lavatory, with two faucets, trap and hanger	72 pounds
5-foot bath tub, with waste	295 pounds
Flat back lipped urinal with fittings	40 pounds
Shower over bath tub, including curtain, curtain ring and shower head, pins and hold-back chain	9 pounds
20 by 24 by 12-inch galvanized or enameled galley sink, with tray	74 pounds
20 by 30 by 12-inch galvanized or enameled galley sink, with tray	94 pounds
¾-inch brass faucets, compression or self-closing	1 pound
Toilet rack	17 pounds
Syphon jet closet bowl with seat and cover floor flange	80 pounds
14-inch grab rod	2½ pounds
20-inch nickel plated towel rack	1 pound
Pressed steel soap dish	7 ounces
Combined sponge and soap holder	1½ pounds
4-foot heaters with valves	46 pounds
Galley pump, 2-inch	17 pounds
Galley pump, 2½-inch	26 pounds
Galley pump, 2-inch	9½ pounds
Galley pump, 2½-inch	15 pounds
Distributing cocks, two way	5 pounds
Paper holders	8 ounces
Shower head, 6-inch	2 pounds
Mirror, 16-inch by 20-inch	9 pounds
Mirror, 18-inch by 24-inch	11 pounds

Passenger and Freight Steamship Aeolus

General Information

Service: New York and South America, passenger and freight.

Builder: F. Schichau, Danzig, Germany. Reconditioned by Baltimore Dry Docks & Shipbuilding Company, Baltimore, Md.

Owner: United States Shipping Board. Allocated to Munson Steamship Company, New York.

Characteristics

Length, overall.....580 feet 10⅞ inches
Length between perpendiculars.....561 feet 5/16 inch
Breadth, molded.....62 feet 4-1/16 inches
Depth, molded.....39 feet 4-7/16 inches
Draft, loaded, summer.....30 feet ½ inch
Draft, light .....
Block coefficient.....0.748
Midship section coefficient.....0.965
Longitudinal coefficient 0.773
Speed, loaded, knots.....15½
Cruising radius, nautical miles.....16,000
Framing .....Transverse
Class ....A1 American Bureau of Shipping

Tonnages

(In tons of 2,240 pounds)

*Weight of Hull .....
**Weight of Propelling Machinery.....
Deadweight Capacity.....11,205
Displacement 22,450

(In tons of 100 cubic feet)

Gross register 12,642.63
Net register 6,992.00

*Weight of Hull includes Hull Proper, Hull Fittings, Equipment, and Outfit.

**Weight of Propelling Machinery includes Engines, Boilers (Wet), Shafting, Propellers, and Machinery Space Auxiliaries.

Canal Ratings

(In tons of 100 cubic feet)

	Gross	Net
Suez		
Panama	15,041.14	9,569.30

Complement

Deck officers.....	5
Deck crew.....	48
Engineer officers.....	5
Engineer crew.....	52
Purser's and steward's department.....134	
Total officers and crew.....	244
First-class passengers.....	194
Second-class passengers.....	176
Third-class passengers.....	104
Fourth-class passengers.....	
Total passengers.....	474
Total complement.....	718

Handling Equipment

	No.	Type	Capacity	Length
Masts	2	Pole		160 feet above L. W. L.
Derrick posts	2			24 feet above deck
Booms	20		3 Tons	

Discharging Capacity....210 tons per hour

Deck Machinery

Steering Gear.....Brown steam tiller with telemotor control.
Windlass (1) .....Clark-Chapman Co.
Capstans (4) .....Clark-Chapman Co.
Winches (14) .....German make

Life Saving Equipment

Lifeboats	No.	Type	Length
	2	Open	20 feet
	1	"	30 "
	*1	"	26 "
	12	Desked	26 "

* Motorboat.

Propelling Machinery

Boilers

Number 7
Type.....5 Dbl. Ended; 2 Single Ended
Length.....Single 10 feet 3 inches
Double 20 feet 6 inches
Width or Diameter.....14 feet 2 inches
Furnaces..3 in each S. E.; 6 in each D. E.
Fuel .....Oil
Draft .....Natural
Total heating surface, square feet.. 25,833
Total grate surface or furnace volume .....697 square feet
Superheat, degrees F .....
Working pressure, pounds per square inch 220
Normal fuel consumption:
Per day, tons.....115.8
Per horsepower hour, pounds....1.20
Normal steam production:
Per hour per pound of fuel..12.95 lbs.
Total per hour .....140,000 lbs.

Engines

Number 2
Type..Quadruple Expansion Reciprocating
Size.....28.05 inches, 41.34 inches, 59.55 inches, 84.27 inches × 53.75 inches.
Horsepower, normal.....9,000 I. H. P.
maximum .....

Propellers

Number 2
Type.....4-bladed, built-up, bronze
Weight.....35,400 pounds each.
Diameter .....17 feet 9 inches
Pitch .....20 feet 3 inches
R. P. M.....81.50
Projected area .....69.12 square feet
Developed area .....80.4 square feet

Auxiliary Machinery

Refrigerating Machinery

2-60 Ton each. Frick CO_2 Compressors
2 Evaporators
2 Condensers
2 Brine Pumps 7½ inches x 10¼ inches x 10 inches.
2 Circulating Pumps
2 Drinking Water Pumps

Machinery Space

Condensers...2 Main; total cooling surface 12,044 square feet; 4834 tubes, ¾ inches dia., 13 feet 4¼ inches long.
Evaporators.....2-40 ton Row & Davis
Distiller.....1-40 ton Row & Davis
Filters....1 Aerating, 30 inches x 30 inches Row and Davis
1 Feed Water, 5 inches—Row & Davis
Feed water heater....1-2 pass Row & Davis
Pumps
2 Main circulating, 48 inches impeller, 18 inches suc., 18 inches disch., engine 8¾ inches x 13¾ inches x 10 inches
2 Main air, plunger type, 24 inches x 25 inches
1 Aux. air, 10 inches x 20 inches x 16 inches, V. S., Worthington
2 Sanitary 6¼ inches x 25 inches
2 Bilge, 6¼ inches x 25 inches
1 Fire, 12 inches x 14 inches x 12 inches, V. D., Worthington
2 Feed, 18½ inches x 13½ inches x 24 inches, V. S., Worthington
1 Fuel Oil Transfer, Epping-Carpenter
4 Fuel Oil Service, Dean
Oil heaters 6-18-inch steel, White

Electric Equipment

Generators..1-100 k.w. Turbo-Gen. Electric
Radio.....2 K. W. Marconi

Holds

No.	Length	Hatches
1	39'0"	10'0" x 11'0"
2	47'6"	15'0" x 16'0"
3	47'6"	22'6" x 16'0"

Capacities

Cargo Space

Compartment	Bales, Cu. Ft.
No. 1 Hold	16,555
No. 2 Hold	33,959
No. 3 Hold	36,444
No. 1 Lower 'Tween Deck	8,470
No. 2 " " "	17,124
No. 3 " " "	18,836
No. 2 Upper " "	17,692
No. 3 " " "	18,936
No. 1 Hatch Trunk	3,220
No. 2 " "	2,558
No. 3 " "	3,856
No. 4 " "	3,871
No. 5 " "	5,542
No. 6 " "	3,978
Total	191,041

Refrigerated Space

Compartment	Cu. Ft.
No. 4 Lower 'Tween Deck	6,090
No. 5 " " "	12,804
No. 6 " " "	12,317
No. 5 Upper " "	14,115
No. 6 " " "	12,918
Total Ref. Cargo Space.....	58,244
Refrigerating Space for Ship's Use	
No. 4 Upper 'Tween Deck....	8,783
Total Refrigerated Space....	67,027

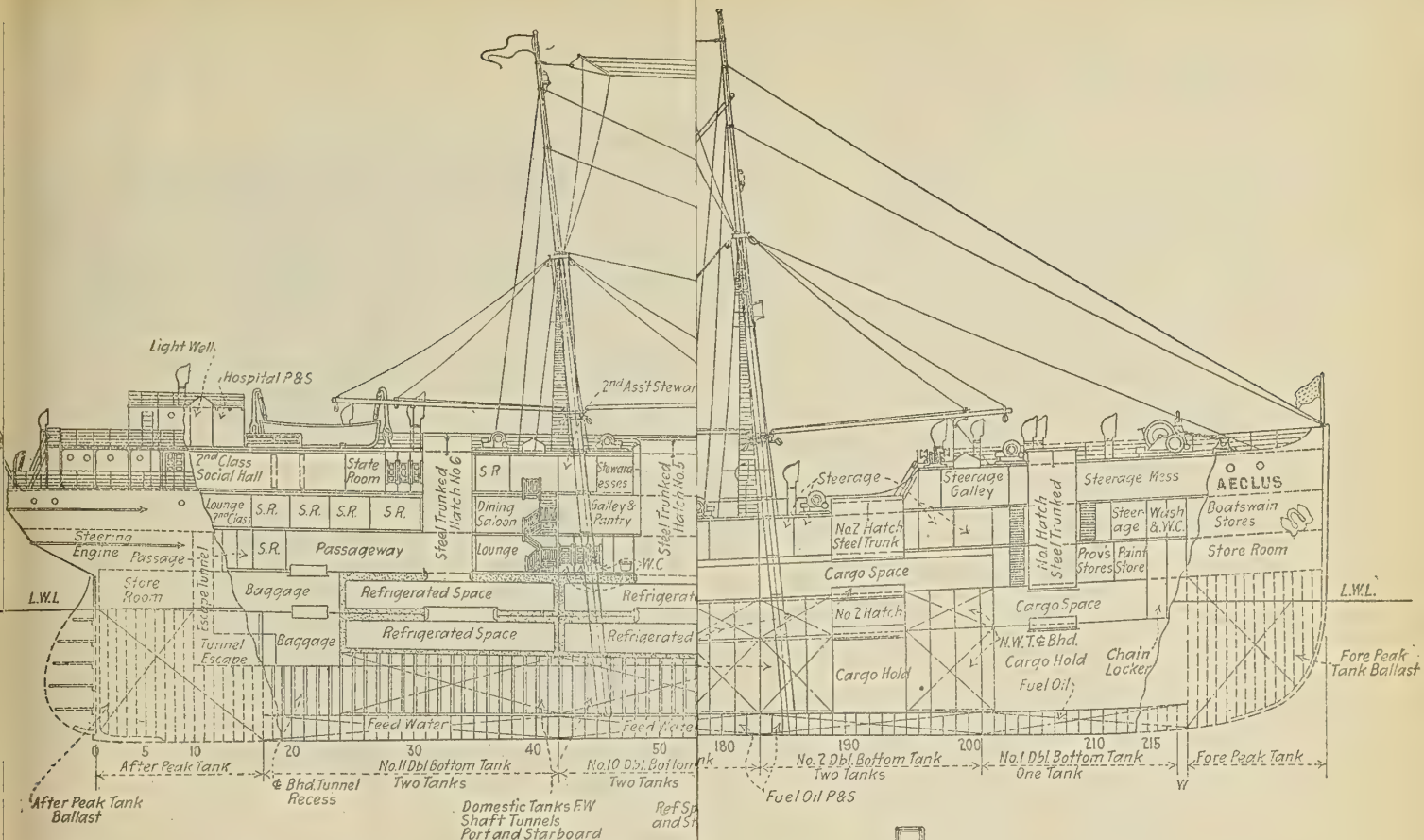
Bunkers

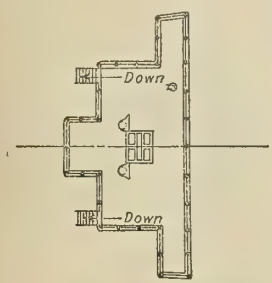
(Compartment)	Cu. Ft.	*Bbls.	*Tons
No. 1 Dbl. Bottom P. & S.	1,650	294	43
No. 2 " " "	4,020	716	104
No. 3 " " "	6,636	1,182	172
No. 4 " " "	9,728	1,732	252
No. 5 " " "	9,898	1,762	258
No. 6 " " "	9,428	1,680	244
No. 1 Deep Tank "	53,810	9,584	1,398
No. 2 " "	48,377	8,616	1,257
No. 3 " "	51,390	9,152	1,334
No. 4 Wing " "	8,588	1,530	224
No. 5 Settling Tanks "	14,156	2,522	368
No. 6 Wing " "	8,166	1,454	212
Total	225,847	40,224	5,866

*38.5 Cubic Feet per Ton; 42 gallons per barrel

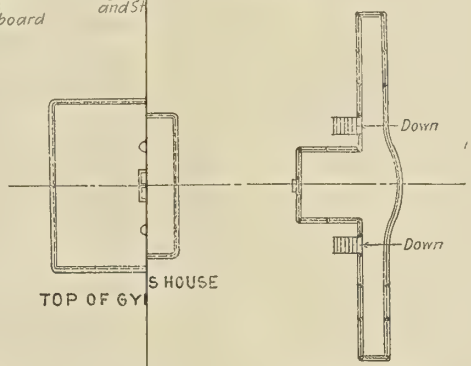
Tanks

(Compartment)	Cu. Ft.	Tons. F. W.	Tons. S. W.
Fore Peak Tank.....	7,239	201	207
No. 7 Dbl. Bottom P. & S.	4,446	124	
No. 8 " " "	3,268	90	
No. 9 " " "	3,554	98	
No. 10 " " "	4,944	138	
No. 11 " " "	3,107	86	
After Peak Tank.....	5,085	141	145
No. 7 Wing Tank P. & S.	6,280	174	
No. 8 " " "	8,156	226	
No. 9 Deep " "	22,436	623	
No. 10 " " "	16,150	449	
Gravity Tanks.....	372	9	
Total	85,037	2,361	352





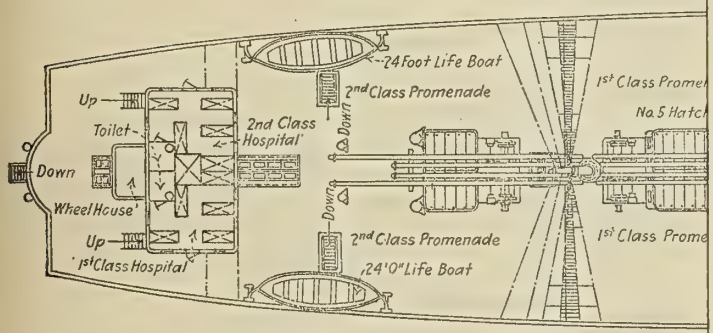
DOCKING BRIDGE

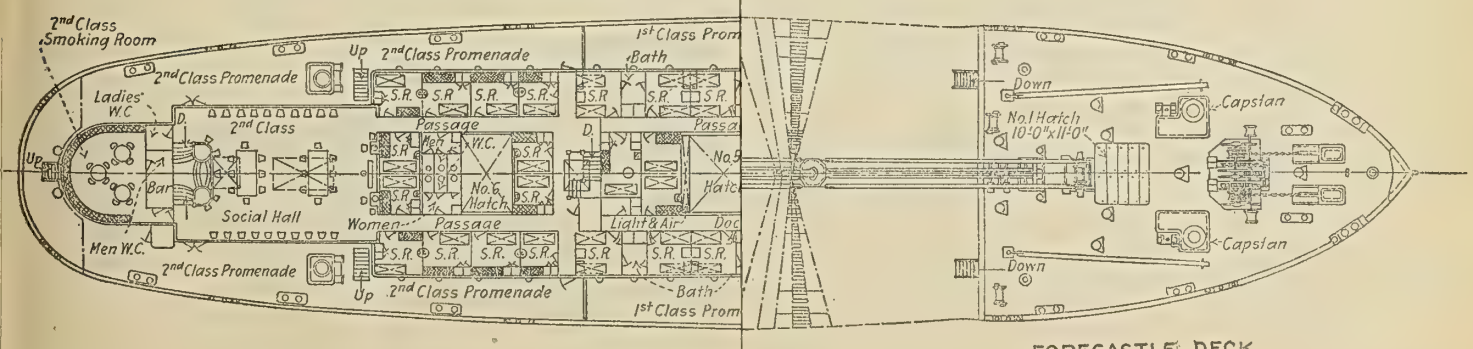


TOP OF GY S HOUSE

FLYING BRIDGE

Height of Eye on flying Bridge about 49'0 above 30'0" Water Line





FORECASTLE DECK

STEAMSHIP AEOLUS

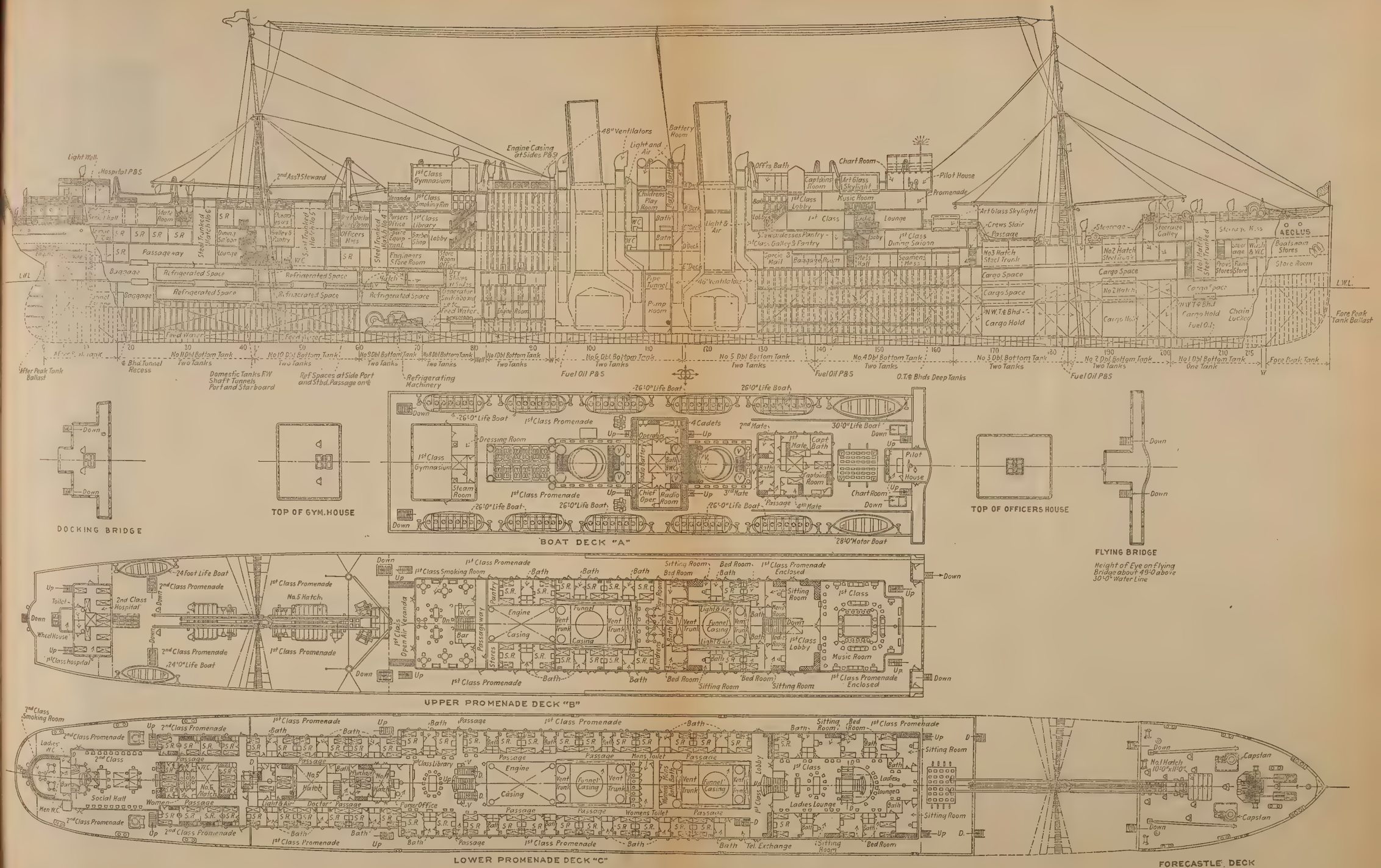
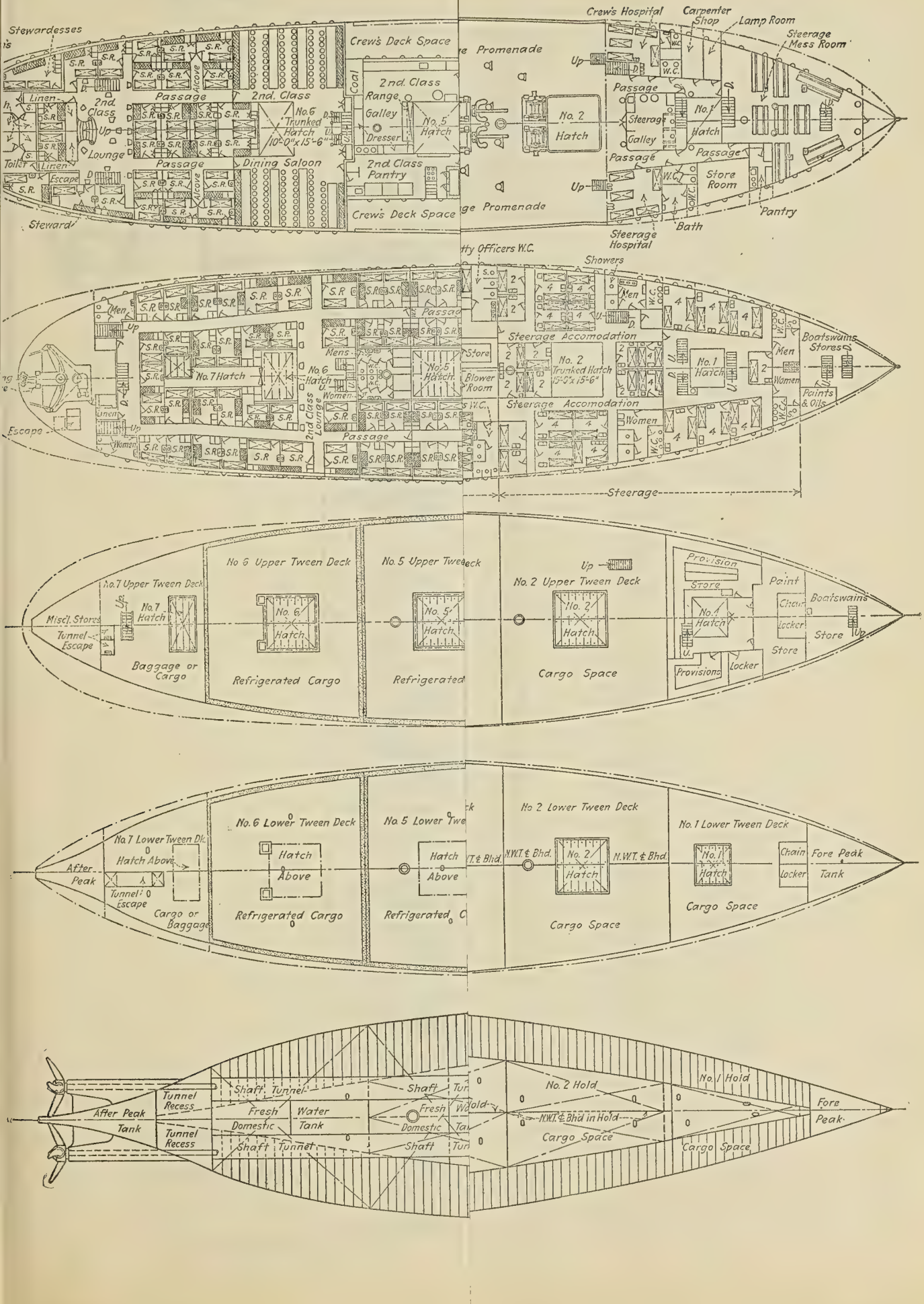


Fig. 1.—Profile and Deck Plans


Stewardesses
Crew's Hospital
Carpenter Shop
Lamp Room
Steerage Mess Room
Crew's Deck Space
Promenade
2nd. Class Range
Galley
Dresser
No. 5 Hatch
No. 2 Hatch
No. 1 Hatch
Steerage Galley
Passage
Linen
2nd. Class
Lounge
No. 6 Trunked Hatch 10'-0" x 15'-6"
Dining Saloon
2nd. Class Pantry
Toilet
Escape
Store Room
Pantry
Steward
Steerage Hospital
Bath
Officers W.C.
Showers
Men
Women
Steerage Accomodation
No. 2 Trunked Hatch 15'-0" x 15'-6"
No. 7 Hatch
No. 6 Hatch
No. 5 Hatch
No. 1 Hatch
Store
Blower Room
Boatswains Stores
Paints & Oils
Linen
2nd Class Lounge
Steerage
No. 6 Upper Tween Deck
No. 5 Upper Tween Deck
No. 2 Upper Tween Deck
No. 7 Upper Tween Deck
Provision Store
Paint
Chain Locker
Boatswains Store
Misc'l. Stores
Tunnel Escape
No. 7 Hatch
No. 6 Hatch
No. 5 Hatch
No. 2 Hatch
No. 1 Hatch
Baggage or Cargo
Refrigerated Cargo
Refrigerated
Cargo Space
Provisions
Locker
No. 6 Lower Tween Deck
No. 5 Lower Tween Deck
No. 2 Lower Tween Deck
No. 1 Lower Tween Deck
No. 7 Lower Tween Dk.
Hatch Above
After Peak
Tunnel Escape
Cargo or Baggage
Refrigerated Cargo
N.W.T. & Bhd.
Chain Locker
Fore Peak Tank
Tunnel Recess
Shaft Tunnel
After Peak Tank
Fresh Water Tank
Domestic
No. 2 Hold
No. 1 Hold
N.W.T. & Bhd in Hold
Cargo Space
Fore Peak

STEAMSHIP AEOLUS

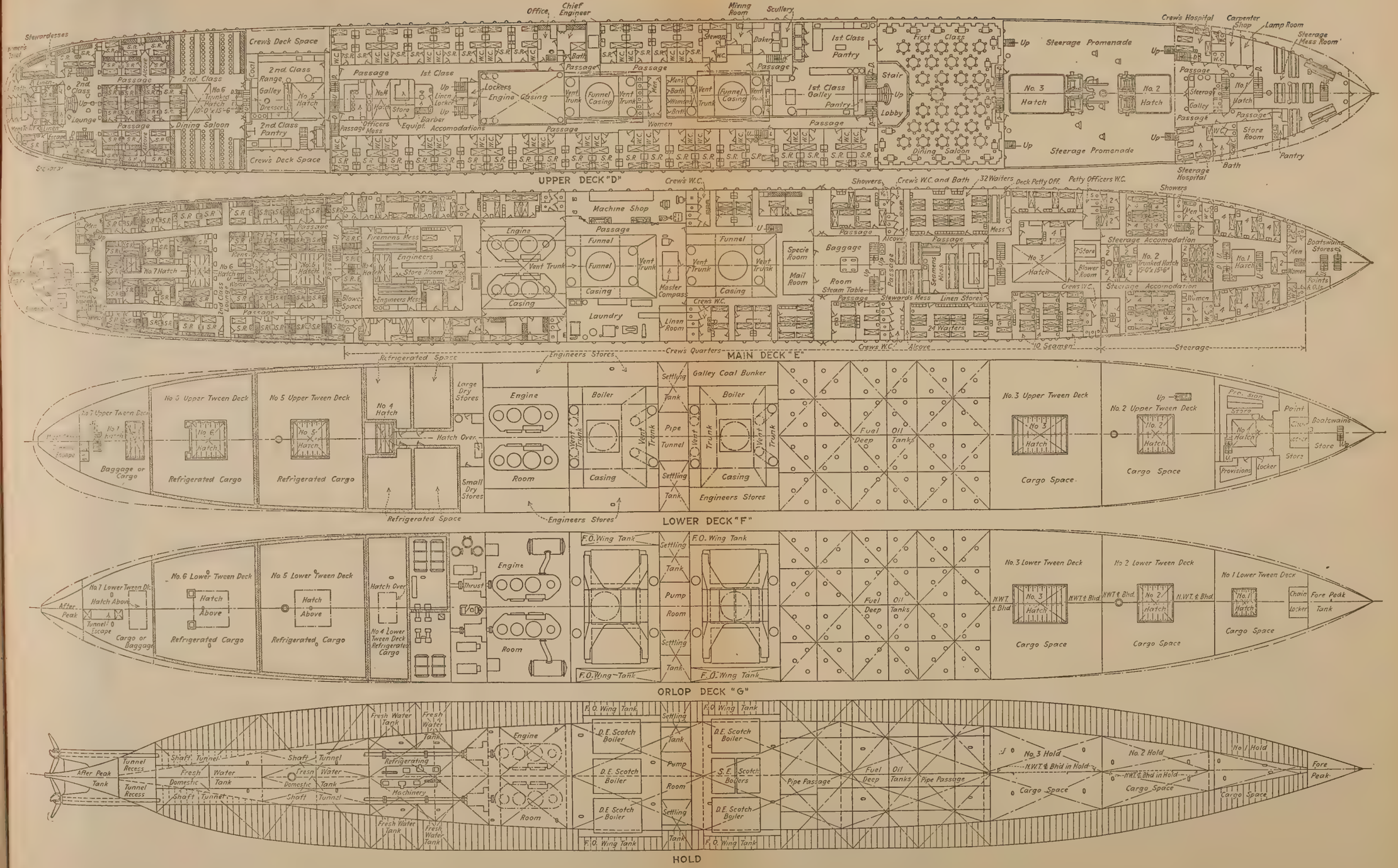


Fig. 2.—Deck Plans

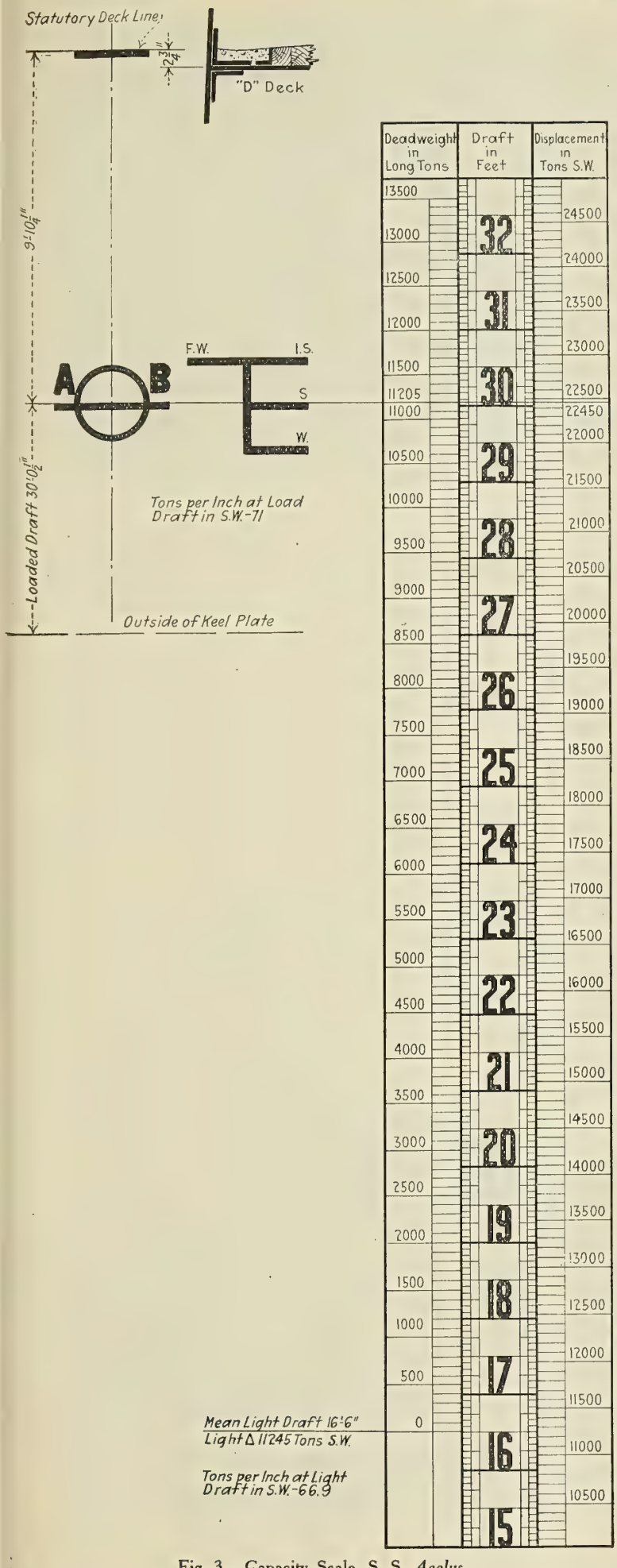


Fig. 3.—Capacity Scale, S. S. *Aeolus*

A Cubist Ship

THE steamship *Newton,* which has recently passed through the hands of the refitting gangs of the Erie Basin plant of the Robins Dry Dock and Repair Company, is one of the new "cubist" boats turned out on a straight line method. This ship is peculiar in that she has vertical sides down to a bilge which is cut off at an angle of about 45 degrees. The bilge plate is carried flat and lapped onto the side and bottom plating.

The upper knuckle which is produced by this method of construction is carried forward into a "chime" or sharp knuckle which is allowed to die away as it approaches the stem. The after end of the bilge is carried along in the same

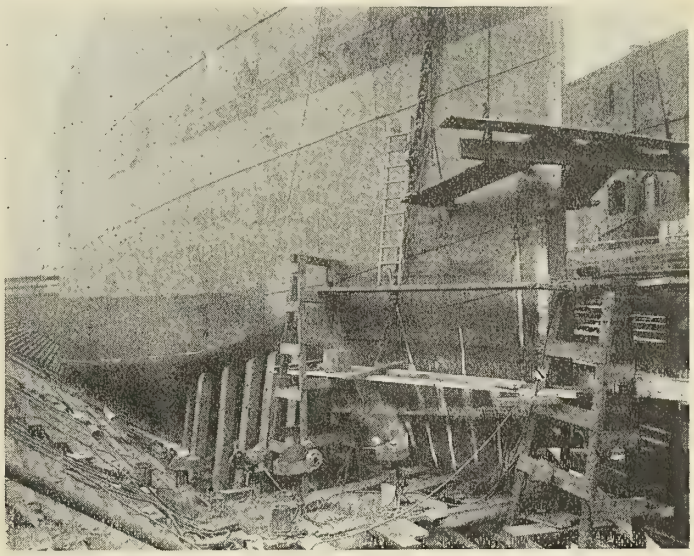


Fig. 1.—The Flat Bilge Plate of the *Newton* Ends Forward in a Chime Which is Carried Well Toward the Stem

manner as forward, only the knuckle fades into the "run" of the ship and appears to be swung in an upward curve to meet the other side of the shell plating, aft of the rudder, in a sharp line.

To add to the odd outlines of the vessel the stern is cut square off at right angles to the centerline. This gives a section resembling a triangle, except that the sides of the ship being slightly "flared" the side of the triangle are not really straight lines.

The bows of the ship are quite shipshape, and above water

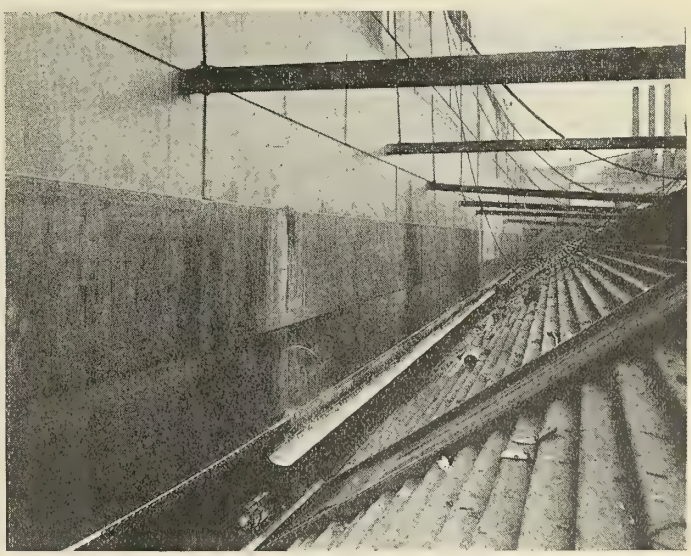


Fig. 2.—Bilge Keels Were Fitted to the Flat Diagonal Bilge Plate of the *Newton* When Undergoing Repairs

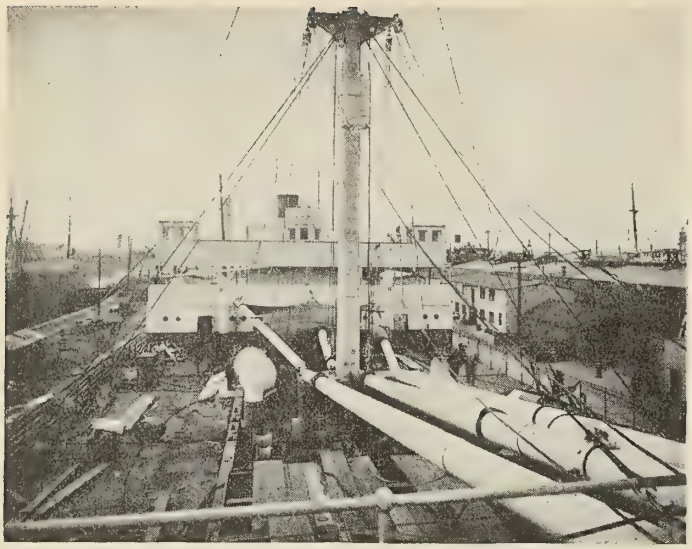


Fig. 3.—Simplified Methods of Fabrication Were Used on the *Newton* to the Fullest Extent. Ventilator Hoods, Lower Masts and Other Fittings Were Made With Square Corners or Knuckles for Ease in Workmanship. Only the Cargo Booms and Topmasts Retained a Round Section

there is nothing to indicate anything out of the ordinary in the construction of the boat. The flat bilge strake of plating is secured at the butts by outside straps. Masts and other deck erections are also square in section and the same idea of ease in fabricating the material is held in the deck houses and other deck fittings.

The *Newton* has been overhauled, as considerable of her shell plating was in need of fairing and renewing. A great many plates were either faired in place, removed and faired, or else entirely replaced with new plates.

The yard workmen have one specially good job to their credit on this work. A portion of the lower end of the stem had to be replaced, and as a new casting would require considerable time for a new pattern, casting, machine shop work, etc., the blacksmiths were called upon to see what they could do. The result was they secured a large ingot, worked it into the shape required and the whole job was ready for the work of installing in place within a very short time.

Fig. 5.—To Avoid a Long Delay in Securing a Casting the Blacksmith Shop Obtained a Heavy Ingot and Used a Steam Hammer in Working Out a Dished Plate of the Required Shape for a New Shoe

The rudder plate was faired and all sea connections overhauled while the ship was in dry dock. Some deck damage was repaired, as the rail and stanchions on the port quarter were broken. Two of the lifeboats were sent ashore for renewals of some broken planks. The tail shaft was drawn while in dock and the old propeller was unshipped, sent on deck and the spare one shipped in its place.

All ballast and peak tanks were tested for watertightness and any loose rivets found in the hull plating were removed and new ones driven.

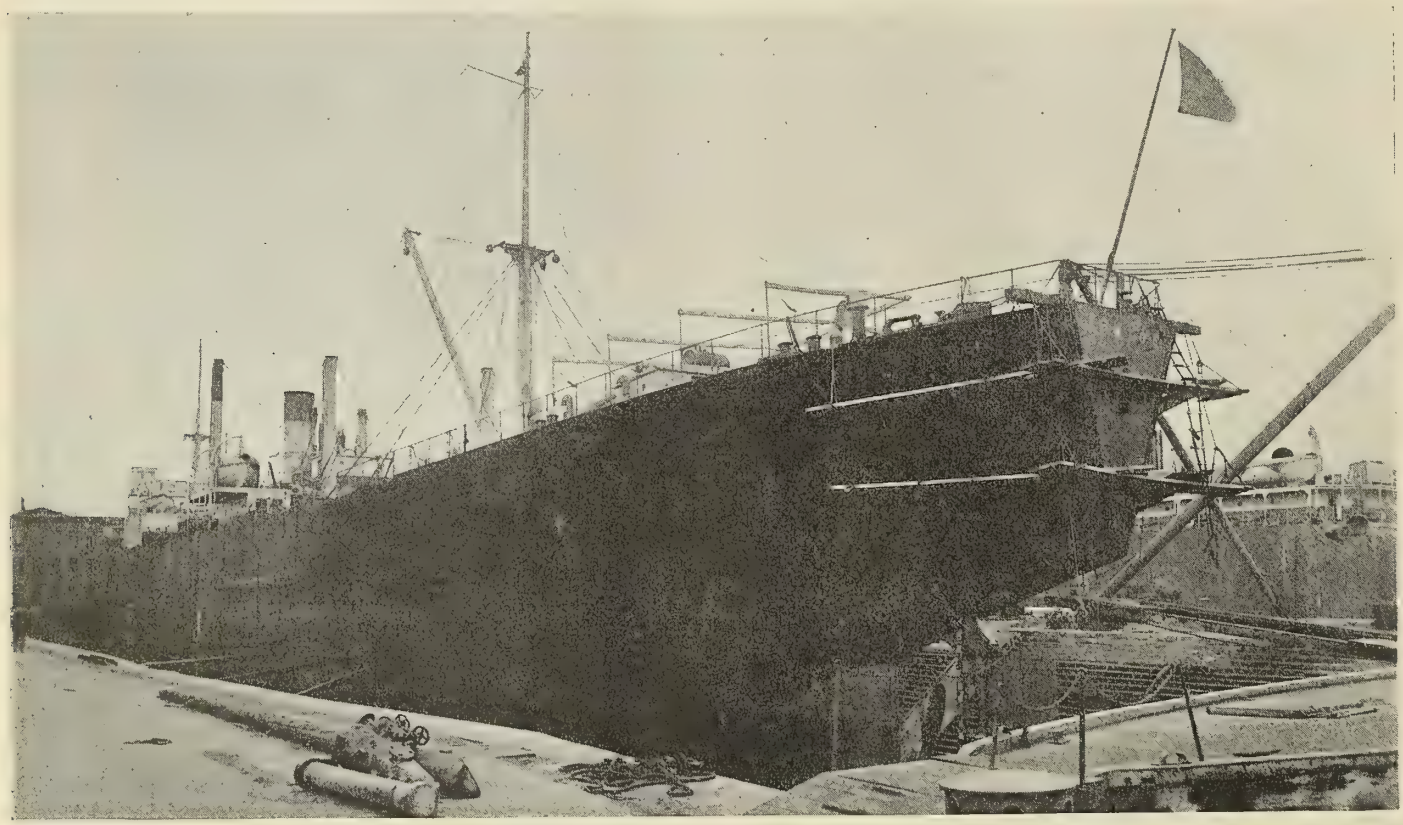


Fig. 4.—The Peculiar Style of Framing of the *Newton* is Shown by This View of the Stern, the upper Knuckle of the Bilge Being Carried In to the Run and Meeting the Other Side Plating on the Centerline of the Ship

Fig. 1.—Sketch of United States Scout Cruisers Nos. 4 to 13, Inclusive

New Scout Cruisers of Immense Engine Power

The new United States light cruisers now under construction will be the most effective scouting vessels ever built by any nation. They will be swift enough to outrun anything afloat. large enough to keep their speed in heavy seas, roomy enough to rush detachments of marines to "trouble spots," and powerful enough to overwhelm destroyers and other light craft.

WITH a length of 550 feet, a beam of 55 feet, a displacement of 7,100 tons, a maximum speed of 35 knots, and a complement of 330 officers and men, the new scout cruisers for the United States Navy carry twelve of the new 53-caliber 6-inch guns, mounted in turrets located forward and aft, and also have torpedo tubes and anti-aircraft guns. Light but efficient vertical and horizontal armor protects the machinery spaces. A new feature, never before incorporated in any ship of the powerful military type, is the complete equipment on each ship for launching and operating four hydro aeroplanes.

Ten vessels of this class are called for on the present programme, and of these, three—the *Omaha, Milwaukee* and *Cincinnati*—are near completion at the yards of the Todd Dry Dock and Construction Company, Tacoma, Wash., and will be commissioned in the near future.

The Propelling Machinery

Interesting as these vessels are as naval units, they are perhaps even more so from the standpoint of steam engineering, since each is to be driven by geared turbines having a total capacity of 90,000 horsepower. Never before has so large an amount of power been installed in so small a space.

Each ship has four 22,500-horsepower cross-compound Westinghouse turbines, and each turibne is geared to a propeller. The turbines for the two center propellers are placed together in an engine room located well aft, and the turbines for the wing propellers are placed in a second engine room farther forward, with the boiler rooms between the two engine rooms.

Each turbine consists of a high pressure and a low pressure element which drive the propeller through a common gear. The high pressure element consists of two rows of impulse

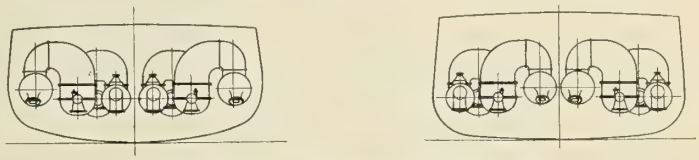


Fig. 3.—Sections Through Engine Rooms

blading followed by reaction blading. A special belt of this reaction blading is used only when running at low speeds and is by-passed for operation at higher speeds. The low pressure element, which normally receives steam from the high pressure element and discharges it into the condenser, has reaction blading only. Both elements are rated at 11,250 horsepower each, and either can be used independently in case the other is out of service for any reason.

An astern turbine, consisting of two rows of impulse blading, is incorporated in each low pressure element. When supplied with the same amount of steam as for full ahead

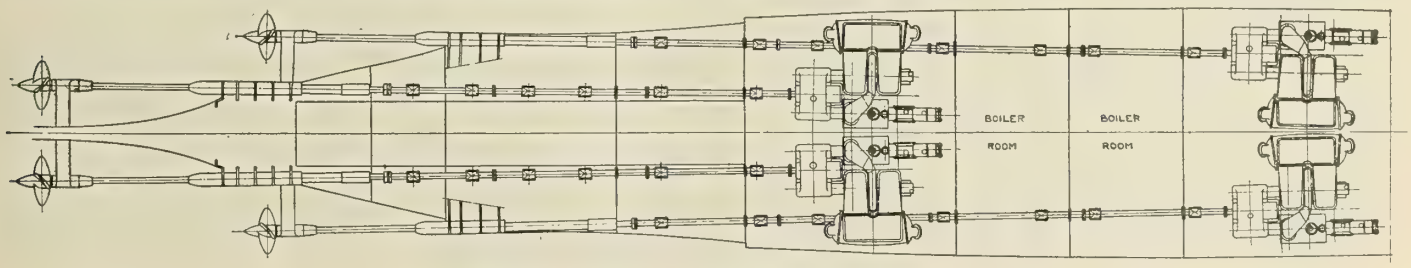


Fig. 2.—Arrangement of Propelling Machinery

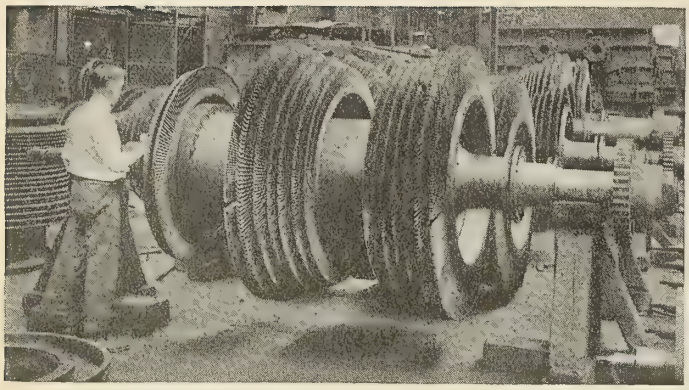


Fig. 4.—Low Pressure Rotors

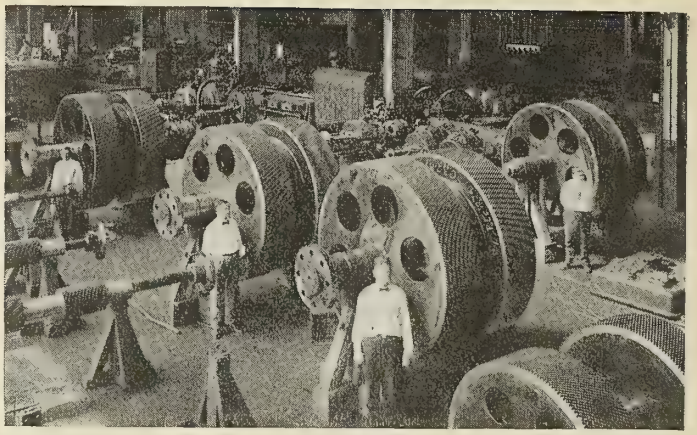


Fig. 5.—Gear Wheels

operation, the astern turbines can develop 30 percent of the full ahead power and can drive the ship at about 20 knots.

Main Gears

The reduction gears are of the Westinghouse floating frame type. Each has two pinions, one for the high pressure and one for the low pressure rotors, and a single gear wheel connected to the propeller shaft. The speed reduction ratio is about 7 to 1 and is effected in a single step.

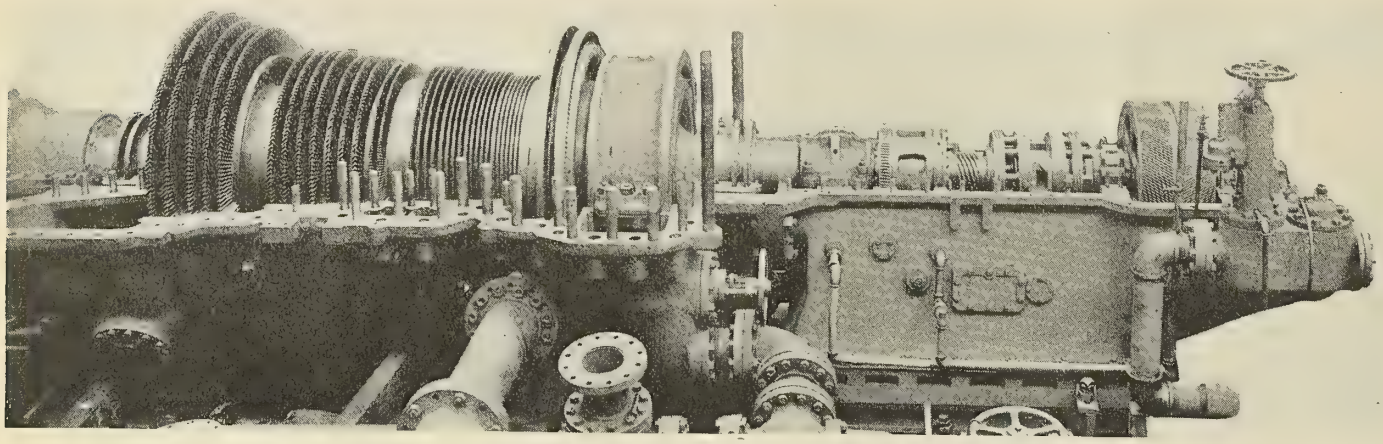


Fig. 6.—High Pressure and Cruising Turbines With Covers Removed

The Cruising Turbines

The main turbines can propel the ship at speeds ranging from 12 to 35 knots, but as only a relatively small amount of power is needed for low speeds, small auxiliary turbines are used for cruising purposes. There are four of these cruising turbines per ship and each consists of a single row impulse wheel and can develop 420 shaft horsepower at 6,000 revolutions per minute. Each cruising turbine is mounted on an extension of the case of a main high pressure element and can be coupled to the high pressure rotor through a gear giving a speed reduction of about 6 to 1. The mechanical line-up is, therefore: Cruising turbine, cruising gear, coupling, main

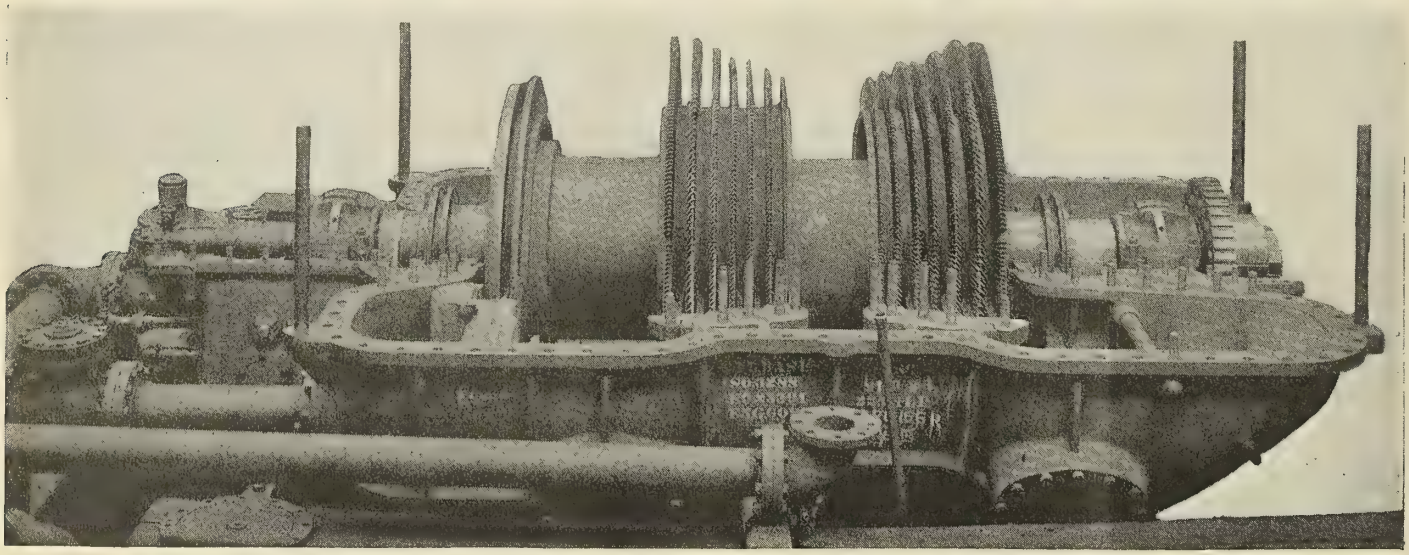


Fig. 7.—Low Pressure Turbine With Covers Removed

high pressure rotor, main low pressure rotor, main gear, propeller shaft.

The steam first passes through the impulse blades of the cruising turbine, then through the reaction blades of the cruising belt of the main high pressure element, then through the remaining reaction blading of both elements, and finally into the condenser. With this arrangement a maximum of 1,000 horsepower can be obtained from each of the four turbines. The cruising speeds range from 12 to 15 knots, with excellent steam economy over the entire range.

The coupling that connects the cruising turbine with the rotor of the main turbine is operated by means of a hand lever. To connect a cruising turbine when the main turbine is in operation, the former is brought up to speed and the latter slowed down, until a synchronizing device indicates that the two are operating at the same speed, when the connection can be made with safety.

Special care is taken to prevent the cruising turbines from overspeeding either when operating under their own power or when accidentally left connected to the main turbines and driven by them. A flyball governor controls the throttle to each cruising turbine and also, through a relay, the governor valve of the main turbine. If the cruising turbine operates at 10 percent overspeed, this governor cuts off the steam to both turbines. If this governor should fail to operate at 12 percent overspeed, an emergency stop cuts off the steam to the cruising turbine and disconnects the coupling.

Auxiliaries

Westinghouse air ejectors and air separators are used to maintain vacua of over 29 inches specified for these turbines. The condensate is handled by four Westinghouse turbine-driven centrifugal pumps, each with a maximum capacity of 500,000 pounds of condensate per hour at a head of 65 feet.

National Foreign Trade Council

REALIZING probably more keenly than ever before the imperative necessity of a permanent foreign trade as a stabilizer of American production, the country's exporters will doubtless attend in exceptional numbers the eighth annual convention of the National Foreign Trade Council, scheduled for Cleveland next May. The efforts of the convention will be directed toward securing more definite and aggressive coordination of the varied foreign trade activities and to reinforce them with the decisive co-operation of the various governmental agencies. Incidentally, it is non-partisan and non-political.

The annual conventions are much in the nature of an annual review of the Council's activities in investigating and advising on all phases and movements of national importance that make for an increased volume in the nation's export business. They are really concentrated training schools in foreign trade relations and conditions wherein the attendance is treated to the experiences and best advice of the men who stand highest in the export field, who know its every angle and are qualified best to speak with authority. They assemble the best and most enterprising business brains of the country.

American industrial production during the last ten years has experienced a wonderful and unprecedented growth. Stimulated during the war period by an exceptional foreign demand, manufacturing plants generally increased their producing capacity far beyond their normal requirements. In many instances today their purely domestic trade falls short of consuming their output, with the result that America is more than ever facing a situation where it is imperative that we become a nation of world traders, if our industries are to continue in active operation and our prosperity as a nation is to endure. It is a radical departure from former conditions.

In the old days the American manufacturer, generally speaking, was content with his domestic trade. He looked to the foreign markets only in periods of overproduction or depression at home. Under those conditions he shipped his surplus stock abroad with selling instructions and made the best of a bargain that usually was unsatisfactory. His interest in foreign trade naturally was not overly keen. He made no effort to extend his foreign acquaintance and connections. For years our exports, chiefly promoted by the larger industrial interests, averaged but a trifle in excess of 7 percent of our production.

Under the stimulus of a war-made foreign demand American exports increased from less than two and one-half billions in 1913 to more than eight billions in 1920. The remarkable period of prosperity that attended this revolutionary condition fully awoke the American manufacturer to the tremendous possibilities of a well-developed and permanent foreign trade. But out of it all grew no really definite and lasting foreign connections for the great majority of those who profited chiefly from munition making. It is this class of manufacturer who should be most keenly interested in the problems that will come up for discussion before the next National Foreign Trade Council convention.

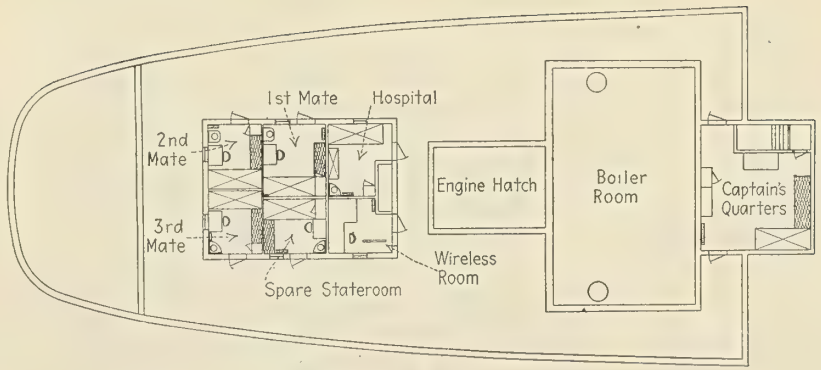
Necessity for Foreign Trade

In his address before the recent annual meeting of the Council in New York, James A. Farrell, chairman, particularly stressed the need of a permanent foreign trade. "In practically every business," he said, "there is a part of the production, roughly estimated as the last 20 percent, which cannot remain unsold if the first 80 percent of the sales are to prove profitable. Remove this last 20 percent and the whole operation ceases to show a profit. So it is with the productive capacity of the United States: a certain volume of foreign sales must be maintained or the industry of the country will suffer throughout."

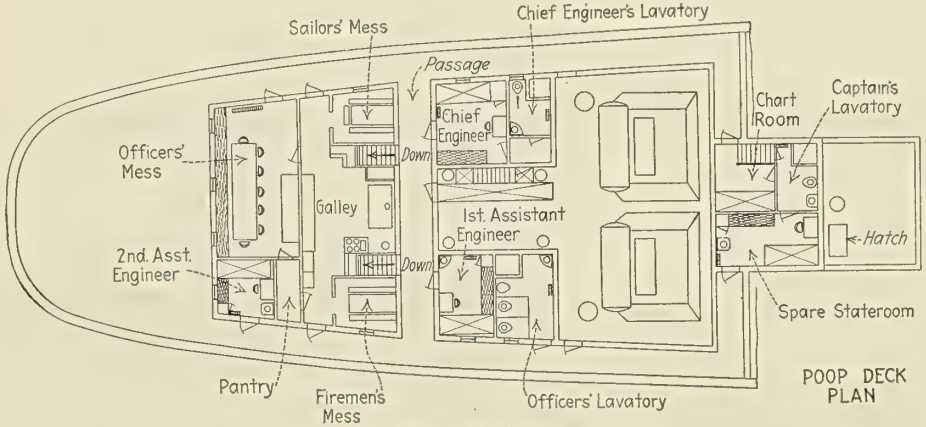
Mr. Farrell declared further that the recent industrial slowing up might have been avoided "had our producers shown more desire to add the demands of an understocked world to those of the local markets of the United States." He held it imperative to the continued prosperity of America that every manufacturer engage in export business and allocate some definite portion of his output to foreign trade. That the convention will resolve for more active governmental co-operation was foreshadowed in his statement that "other nations, older in the field, control cables, coaling stations, harbor and terminal privileges, banking facilities and railroad and shipping systems. It is doubtful whether private American enterprise can at this late date obtain similar facilities unaided."

With the industrial interests of Europe rapidly becoming rehabilitated and our exports on the decline, it behooves American industry to make speedy and exceptional effort to keep alive the friendly relationships formed when the world's markets were open to our products. A dependable foreign trade will provide a highly beneficial vehicle for carrying any line of manufacturing over periods of dullness at home, permit increased output and insure the plant constant operation, while enabling a lowering of overhead charges and making possible the manufacture of goods at a lower price through increased production. These are problems certain to come before the Cleveland convention for exhaustive discussion.

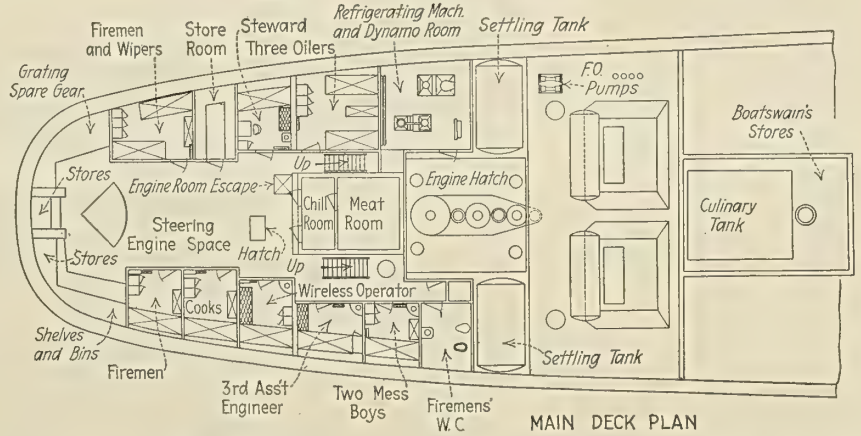
The Cleveland convention committee of fifty is officered as follows: Samuel Mather, Pickands, Mather & Company, honorary chairman; E. R. Fancher, governor of the Federal Reserve Bank; Myron T. Herrick, prresident the Society for Savings; Henry Howard, the Grasselli Chemical Company; William P. Palmer, president the American Steel & Wire Company; and Ambrose Swasey, president the Warner-Swasey Company, honorary vice-chairman; and H. F. Seymour, the Columbian Hardware Company, executive chairman.



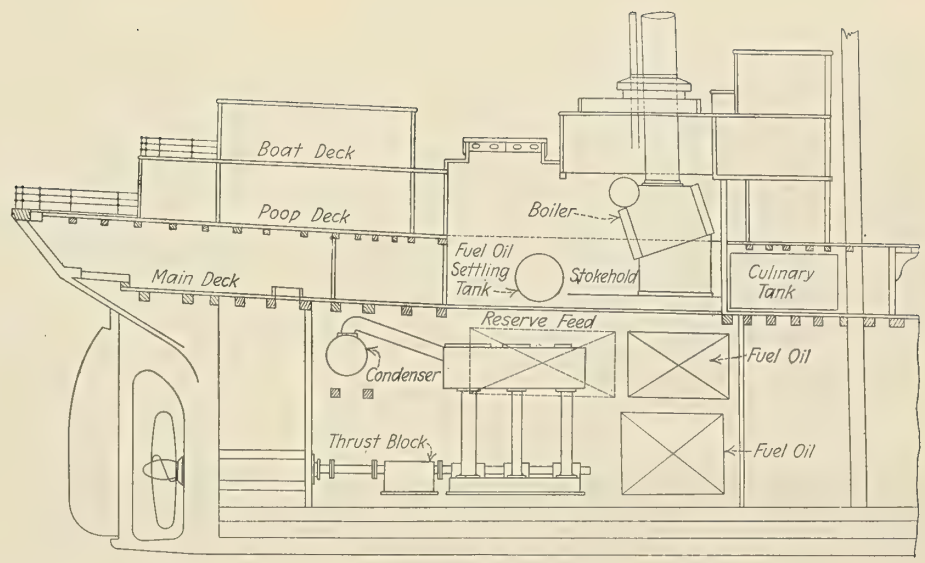
BOAT DECK PLAN



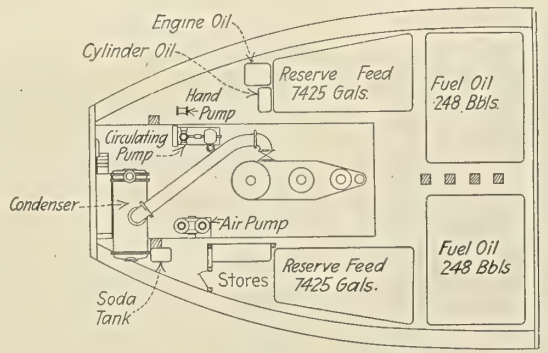
POOP DECK PLAN



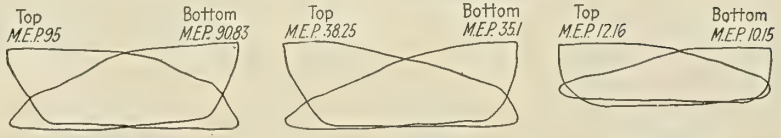
MAIN DECK PLAN



INBOARD PROFILE



TWEEN DECK PLAN IN ENGINE ROOM



H.P CYLINDER I.P CYLINDER L.P. CYLINDER

IND. HORSE POWER

Cyl.	Top	Bottom	Comb
H.P.	220.62	196.34	416.96
I.P.	251.97	225.58	477.55
L.P.	245.32	203.14	448.46
		Total	1342.97

Fig. 1.—General Arrangement Plans in Way of Machinery Space of Ferris Type Wooden Vessel After Conversion Into Lumber Carrier. Indicator Cards from Main Engine

21265

Ferris Type Wooden Hull Proves Efficient Lumber Carrier

BY JOHN J. MUIR*

IN the early part of this year Albert Schubach, of Seattle, Wash., in conjunction with other Seattle capitalists, purchased a Ferris type wooden hull from the United States Shipping Board Emergency Fleet Corporation. It was decided to equip the vessel in the most suitable and up-to-date manner as an efficient lumber carrier. This work was put in the hands of the Grays Harbor Motor Ship Corporation, Grays Harbor, Wash., under the supervision of Captain W. A. Magee, formerly district manager for the Seattle district of the Emergency Fleet Corporation for the hull and equipment, while the installation of machinery and boilers was under the direction of William Macdonald, formerly senior performance engineer for the Seattle district of the Emergency Fleet Corporation.

This article is only intended to cover the installation of the machinery and boilers and the arrangement of quarters aft, as this type of hull has already been described in this magazine. There is therefore no need of giving a detailed description of its construction here. Suffice to say that the hull was built by the Grant-Smith Porter Company at their yard in Aberdeen, Wash., and the high class quality of the hulls turned out by this concern is sufficient guarantee that the construction of the hull of the *Forrest King* is first class in every respect, both as regards workmanship and material.

Principal Dimensions

The dimensions of the vessel, which has been given the highest class at Lloyds for wooden vessels, are as follows:

Length on load waterline	267.6 feet
Breadth	46.2 feet
Depth of hold	24 feet
Deadweight capacity on 23-foot draft	3,500 tons
Gross registered tonnage	2,426.45
Net registered tonnage	1,724

New Arrangement

The Ferris type hulls were originally designed for the engines and boilers to be placed amidships, but in the *Forrest King* the propelling machinery is placed as far aft as possible, an arrangement which permits of the stowage of the largest possible cargo of lumber both in the holds and on deck. Fig. 1 shows the new arrangement of machinery spaces and quarters aft and also a typical set of indicator cards.

The engine and boiler room crews' quarters are all located aft on the main deck, and the navigating officers' quarters are located aft on the boat deck. Seamen's quarters, as well as the lamp room and paint and oil rooms, are located in the topgallant forecastle.

The compactness and accessibility of the quarters is noteworthy, particularly the handiness of the galley to the mess rooms and officers' dining room.

Main Propelling Machinery

The main engines, made by the Nordberg Manufacturing Company, of Milwaukee, Wis., are standard Shipping Board design, vertical triple expansion, with cylinders 19 inches, 32 inches and 56 inches diameter by 36 inches stroke. As already stated, they have been placed as far aft as possible, but a short intermediate shaft is provided, so that the propeller shaft can be drawn in to allow of a new propeller wheel being fitted. By removing the thrust block as well as the short intermediate shaft, the propeller shaft can be drawn inboard altogether without disturbing any part of the main engines.

* Member American Society of Mechanical Engineers, Seattle, Wash.

The air pump and circulating pump are independent of the main engines, the former being a Blake-Knowles 10-inch by 18-inch by 18-inch by 12-inch twinplex vertical pump and the latter a 10-inch centrifugal pump fitted with high and low suctions and a 6-inch bilge suction.

Engine Room Auxiliaries

All auxiliaries exhaust into the condenser, and when working cargo in port all winches and auxiliaries exhaust into the condenser.

There are two 10-inch by 6-inch by 12-inch duplex pumps installed as a sanitary and fire pump respectively, and the piping is so arranged that either pump can be used as a circulator or air pump on the condenser, thereby avoiding the necessity of operating the main air pump and circulating pump when working cargo in port.

Two 10-inch by 6-inch by 12-inch Blake-Knowles vertical simplex pumps are fitted as main and auxiliary feed pumps respectively and discharge through independent pipe lines direct to the boilers or through the Reilly feed water heater. The feed and filter tank is of 800 gallons capacity and fitted with automatic control for the feed pumps. All drains from traps and auxiliaries are carried back to the filter tank.

A 16-ton Reilly evaporator of the submerged type is also installed for feed water make-up. The independent bilge pump is a 6-inch by 5¾-inch by 6-inch duplex.

Boilers

The main boilers, two in number, made by the Pacific Steel & Boiler Company, of Tacoma, Wash., are also standard Shipping Board design, watertube type. They are designed for 200 pounds steam pressure and fitted with Tracy steam purifiers. The boilers are operated under natural draft and are equipped to burn oil, the Coen direct pressure system being installed with four burners to each boiler. This type of watertube boiler was fully described in the January, 1920, issue of this magazine and was also the subject of a very exhaustive paper presented by Messrs. F. W. Dean and Henry Kreisinger at the annual meeting of the American Society of Mechanical Engineers in December, 1919. This paper gave a complete description of the boilers as well as tabulated results obtained during exhaustive tests. The boilers are placed on the main deck, the stokehold floor being made watertight and placed 18 inches above the deck. This allows all the waste water from washing out the boilers to be delivered overboard, thereby preventing flooding of the deck or engine room.

Fuel Oil System

There are four fuel oil storage tanks in the hold below the boilers having a combined capacity of 1,116 barrels. In addition to this there are four fuel oil tanks amidships having a combined capacity of 1,836 barrels. Settling tanks of 50 barrels capacity each are placed on the port and starboard side respectively on the main deck aft of the stokehold. A 6-inch by 5¾-inch by 6-inch Blake-Knowles duplex pump is installed for transferring the fuel oil from one storage tank to another or from storage tank to settling tank. The duplex fuel oil pumps are in duplicate and the piping is so arranged that they can act as transfer pumps in case of necessity as well as discharge the oil to the burners. The oil manifold, arranged so that oil may be drawn from or discharged into any of the storage tanks, is placed in the engine room with valves for each tank accessible from the starting platform. The filling pipe and valve are also attached to this manifold.

There are six powerful steam winches installed for handling cargo and a steam windlass on the forecastle deck for handling the anchors. There is also a double cylinder steam capstan aft.

The double cylinder steam steering gear is the type made by the American Hoist and Derrick Company, St. Paul, Minn., and operates the rudder by a geared quadrant fitted

with shock absorbers. This steering gear is operated by shaft control from the wheel house on the navigating bridge. There is also a right and left hand screw hand steering gear on the poop deck which can be quickly connected up in the event of the steam gear getting out of order.

The electric light plant is a 10-kilowatt direct connected set made by the Engberg Electric Works, St. Joseph, Mich., and the refrigerating plant is a 1-ton capacity machine made by the Frick Company, Waynesboro, Pa.

When loaded with 1,500,000 feet of lumber and drawing 22 feet 9 inches forward and 23 feet 3 inches aft the *Forrest King* averaged 9.7 knots at sea, the main engines making 91 revolutions per minute and indicating 1,342.97 horsepower. Under these conditions the consumption of fuel oil was 113.8 barrels in 24 hours. This is equivalent to a consumption of 1.18 pounds of fuel oil per developed indicated horsepower, per hour, including all auxiliaries, assuming the oil to weigh 8 pounds per gallon. Considered in all its aspects, the *Forrest King* can be classed as one of the most efficient and economical installations of her class afloat. The machinery installation is very flexible, all emergencies and contingencies being carefully considered and fully provided for, while at the same time the number of auxiliaries is reduced to a minimum.

Commander Gatewood Discusses Ship Repairs With Seagoing Marine Engineers

AT a recent meeting of the Ocean Marine Engineers Beneficial Association, No. 80, in New York, Commander R. D. Gatewood, director of construction and repairs of the United States Shipping Board, delivered a lecture on the problems which are now confronting the Shipping Board and steamship owners with regard to the excessive cost of repairs on American ships, both at home and abroad. Commander Gatewood was introduced by Captain C. A. McAllister, U.S.C.G. (retired), vice-president of the American Bureau of Shipping, who called attention to the fact that not only are ship repairs costing 50 percent more than the entire cost of wages of officers and crew every month, but that this expense item amounts to approximately six times the cost of repairs on similar British ships each month, and that it lies within the power of marine engineers to eliminate much of this waste. Commander Gatewood's remarks were in part as follows:

If we build ships at outrageous prices and have to pay interest on that price, we cannot make any money and we cannot keep our place on the sea. We get the same freight rates that everybody else gets. We must make money like other people, and people are not in the shipbuilding business for their health or for pleasure; they are in it to make money.

Again, if we have excessive repair bills we cannot make more money than a country that does not have such excessive repair bills. When I get a repair list from a chief engineer I want to feel that it is a repair list that represents the *absolutely necessary* work on that ship; not merely what is desirable, but what is really necessary to have done—work that he cannot properly do himself.

In the first place, we want to stop the alterations on our ships. At present the alteration bill is more than 40 percent of our total expenses. For the year ending June 30, 1920, the combined alteration and repair bill amounted to the outrageous sum of $85,000,000. If this sum is divided by the number of ships and by the number of repairs and changes, it is apparent how absolutely problematical it must be for us to operate in competition with Norwegian, British and Japanese ship operators. *Alterations must not even be asked for except when they are absolutely essential.*

The second thing we want is to do our own repairs in our own yards with our own workmen. We want to do as little as we can elsewhere. For the two years during the war that I was in charge of the repair shops at Panama there passed through the Isthmus many large Japanese ships that were on very long voyages. During that time these Japanese ships never asked for as much as a bolt or a nut or a stick of wood. Not a single repair did the Japanese ships ask of the facilities at Panama. They had breakdowns, of course, but when anything went wrong they repaired it on the ship, or if they could not do that they waited until they got home and then had the repairs made. If they can do this, we can, but we are not doing it! Our repair bills abroad are outrageous.

A third thing we want to do is to put our repairs on a basis of competitive bids. If the chief engineers will send in their repair lists complete and not come through later with a lot of extras, these lists will be gone over carefully and the needs of each one of the items discussed with the engineers and the necessary work promptly attended to on the basis of competitive bids. The work will be submitted in contracts to all the reliable firms in the various ports. We will let the best man get it and see that he does his work as it should be done.

In that connection we have two very important rules to apply: First, get your repair list in and get it in complete. Let it cover everything that is needed for the voyage. There is nothing more discouraging or unsatisfactory than to get a repair list and then another and another and another. The firm that gets the first repair list simply charges for the extras as much as it likes. In order to effect any economy, the *complete* repair list must be made up at one time. Next, the engineers must help us get what we are paying for. We can have all the inspectors in the world, but they cannot do half as much as the chief engineer who has to stay up nights when something goes wrong with the ship at sea. I would rather have the O. K. of the chief engineer than of anyone else. If you will help us in that respect we will undertake to give you the best service in the world. If you find a repair plant that does not give good quality and will not be reasonable, let us know about it and we will get after that repair plant and they will not have an easy time of it.

The fourth thing, which lies more heavily on my mind than anything else and for this reason I am reserving it for the last, is the *amount of work that should be done by the ship's force.* There is going on in the repairs of our fleet a most discouraging, a most unfortunate, condition that is growing worse instead of better as regards the amount of work that is done by the ship's crew. I do not ask you to go back to the days when almost everything needed was done by the ship's crew, which worked twelve to fifteen hours a day doing it. All that we are looking for is what is reasonable on the part of efficient men who are interested in the efficient management and operation of the machinery of the vessel in their charge. If you could see some of the items that come in to us, you could hardly look one another in the face. You simply could not do it as Americans and efficient engineers. When you submit a repair list, be sure that there are no items in it that are your own jobs or that are jobs which could and should be done by your own crew.

These four points I want to emphasize as strongly as possible. I have no control over the last, other than to appeal to the respect of the conscientious chief engineer which should prevent any unreasonable item being presented that ought to have been done by the ship's own force, but I do have some control over the others, and if you will help me (and you can, enormously, because your engine room repairs cost over 70 percent of the total cost of repairs) and tell others with whom you may come in contact I will be most grateful to you. If you will report all bad jobs there will be less and less trouble and I will give you all the time and attention that a man can possibly give you. In return, please help us along the lines that I have mentioned.

"Economy, Economy and Yet More Economy"

Existing Conditions Make Economy in Ship Operation Imperative—Operating Costs and Repair Bills Must Be Cut Down

BY "OLD SCOTCH"

WHILE claiming no patent right nor even original thought on the subject of economy in shipbuilding and ship operation, the writer can at least claim for the past ten years many contributions on this very important subject in the columns of MARINE ENGINEERING. During our past four years of national "jag" in shipping matters, but little attention has been paid to any of these preachings: they have figuratively been ruthlessly brushed aside by such remarks as "No time now for tight-wadism," if such a term may be used.

Now, however, we find the subject uppermost in everybody's minds, and it is acutely present in all dissertations on national, state, municipal and private affairs. The first period of the "morning after" is running true to form, as evidenced by the many good resolutions we are considering and adopting. Also, like our prototype, the reforming "souse," we are showing tendencies of going to extremes in our wild endeavors at reformation.

Extreme Measures Impractical

If you do not think so, just read the Washington despatches containing information of the intent of certain congressional committees to cut off all appropriations for the Shipping Board activities, both building and operating. Of course, our national lawmakers are not going to take such a radical step, as it would leave all our shipping activities on their beam ends, but such propositions as have been made are indicative of the extremes to which we, as a nation, are at least considering in the wild scramble to remedy the shortcomings of several years' profligacy, in a few months of acute reformation. It's a good sign nevertheless that out of it all will come considerable reductions and economizing in our national expenditures for shipping and other functional activities of Government.

The officials managing Shipping Board affairs are now thoroughly aroused to their task, and decreasing expenditures for repairs and operations tell the tale of their efforts. The present Director of Construction and Repairs, Commander Gatewood, has called conferences of the leading operators and repair men in New York and vicinity and urged their hearty co-operation in cutting out needless and wasteful expenditures on the Government fleet. He has been promised their assistance, as they recognize in his efforts a sincere and earnest endeavor on the part of the Government to introduce rigid economies in its fleet of Shipping Board vessels, still the predominating part of our merchant marine.

The Depression in Shipping

Already we are beginning to reap some of the bitterness of the intense rivalry we must meet on the seas. The mere fact that many of our sea going craft are tied up to the wharves and idle is not so discouraging in itself, as the daily press advises us that we are not alone in having idle ships. All other maritime nations are having the same depressing experience. The most disturbing indication is the fact that one of our large oil companies has recently found it necessary to tie up some of its American and British case oil carriers plying to the Orient, because Japanese ships can carry these cargoes and make a profit at a freight rate less than the actual cost of transportation on the American and British ships, which have been engaged in the same trade. It must not be assumed that this condition of affairs is going to continue indefinitely, for if it should, we might as well go out of the ocean carrying trade at once. It must, however, bring acutely to our thoughts the reasons and remedies for this state of affairs. None of us will be willing to admit that in normal times the Japanese can build ships so very much cheaper than the Americans and British, handicapped as they are, in costs of material and less efficiency of the labor entering into the construction of their vessels.

Excessive Operating Costs

Such a great discrepancy in the freight rates between the vessels of these three nations must largely be accounted for in the operating costs. Fuel, canal and port charges will be the same for all vessels, so that the great advantages must lie in the lesser costs of wages, food and repairs on the Japanese vessels. We can never expect nor do we desire that wages of American officers and men shall be reduced to the level of that received by the Asiatics, and this item must be compensated for in "adjustments" made possible by our Government in some preferential treatment of its merchant marine. The costly items of repairs and upkeep are probably the most serious with which we have to contend, and this largely resolves itself to the question of relative efficiency of engineering personnel.

The writer recently was informed by a former official of the repair shops maintained by the United States at the Panama Canal that, in the course of several years' observation of the craft of all nations using the Canal, while American and British ships were the most frequent patrons, he had yet to witness the expenditure of a single dollar for repairs by any of the numerous Japanese ships which passed through this great waterway. While this fact speaks volumes for the efficiency of Japanese engineers, it also points out to us where a decided reform can be made on our own ships, and which possibly may be of sufficient import to account largely for the present condition in freight carrying herein cited.

Economies in Ship Repairs

Great economies have already been made in the cost of repairs on our ships, but further economies can and must be made. While it has been quite popular to speak of the rapacity of repair men in our American ports, and to the lax methods of the operating personnel on our ships, the fault is not entirely with these two classes by any means. One of the most important elements in the cost of repairs is the supervisory force, that is the inspection and specification writing people, upon the thoroughness of whose work the expense of making the repairs very largely depends. Superficial inspection and indefinite specifications have been and are still very great sources of wasting money for shipowners in the matter of repairs, and immediate reforms along those lines are paramount.

It is so easy for a man writing specifications to use broad general terms such as "Main feed pump to be thoroughly overhauled and put in first-class working condition," "Steering engine to be overhauled and made to operate successfully with the vessel at full speed," "Port forward boiler to be repaired and made tight under steam at working pressure," etc., etc., and then conclude with that old-fashioned glittering generality "All parts repaired under these specifications

must be made to operate to the entire satisfaction of the inspecting officer: any omissions from these specifications necessary for the successful completion of the repairs enumerated must be furnished by the contractor."

The inefficient and lazy man writing such specifications lies back in his office chair, with the snug satisfaction that he, at least, has performed his function and has protected the shipowner in every way possible from the "rapacity" of the contractor. Anything that he, in his wisdom, has failed to include in his literary effusion will have to be furnished by the "party of the second part," at his own expense, the latter "his" being the meek and lowly contractor.

Let us look on the side of this "party of the second part." In making his estimate, he must, in the case of the feed pump for example, provide against almost any condition which may arise when the pump is taken down, and for the whim of the inspector who will pass on the work. What is the result? The contractor, to protect himself against these contingencies, must name a figure which will cover anything that might arise in connection with the proper functioning of that particular pump in the tests which will be given it, under the broad terms of the loosely drawn specifications. Can you blame them?

How much better and less expensive it would be for the inspector or specification writer to go over that pump with one of the ship's engineers familiar with its delinquencies and find out definitely just what ails it. If a new piston rod is needed for one of the steam cylinders, say so, and give its material and size or other means for identifying just what is to be done and no more. If new valves are said to be needed on the water end, find out just how many new ones are needed, or what repairs are needed to make the old ones function properly. Many and many times, I dare say, in the past few years it would have been much cheaper to have purchased and installed a brand new pump or other small auxiliary than it would have been to make these "general repairs" specified by incompetents.

Competition for business nowadays has largely done away with "gouging" on the part of the contractors for ship repairs. Any one of them, I feel assured, would rather bid on work where it is specifically stated just what he is required to do in definite terms which need no discussion as to their true intent and meaning. No honest contractor, and my experience with them leads me to believe that the great majority of American ship repair men come under that category, wants to be under constant suspicion that he is unduly profiting on the American merchant marine. He must, however, protect himself from *losing* money, and if he has to deal with loosely drawn specifications, it is not his fault that he does look after his own interests.

Times like we are now passing through have a wonderful chastening effect on all of us. We now have time to consider our efforts carefully and to introduce reforms that have heretofore been neglected in the days of "easy money." If we all, individually, take these opportunities to mend our ways, we can as Americans keep our ships sailing the high seas in competition with any and all our competitors. But without strict economy we will run a losing race.

How United States Government Reorganization Will Affect the Merchant Marine

BY WALDON FAWCETT

During the closing days of 1920, *there was enacted by the Congress of the United States a legislative measure that will have lasting influence of wide scope upon the American merchant marine, and, more specifically, upon the governmental agencies that have contact with shipbuilding and shipping interests. Briefly, the law lately placed upon the statute books paves the way for a complete reorganization of the executive branch or administrative system of the United States Government. At least a year will ensue ere its effect will begin to be transmitted to the indusry, but ultimately the consequences, direct and indirect, will prove of moment.*

AS may be surmised, the organization of a joint commission of the United States Senate and House of Representatives to bring about a reorganization of the alministrative branch of the national government injects a new element into the proposal, already reported in these columns, to abolish the United States Shipping Board and vest the control of governmental shipping and shipbuilding property in a Department of the government, headed by a member of the Cabinet. The authorization, in general terms, for an overhauling of the machinery of the government does not specify, as part of the programme, the elevation of the structure of the Shipping Board to departmental status, but, obviously, with the spirit of reorganization in the air, the proposal for the transformation of the Shipping Board will receive more attention than it could gain as an isolated enterprise.

Especially is there opportunity to urge that a merchant marine department be instituted, inasmuch as sponsors of the idea have never contemplated a mere change of name for the Shipping Board, but rather an amalgamation that would associate with the organization now known as the Shipping Board all the existing bureaus and agencies of the government having to do with maritime affairs. This idea of co-ordination and consolidation establishes a bond of sympathy between the special merchant marine project and the general programme of administrative reorganization. The underlying purpose of Congress in the planned shake-up at Washington is to put an end to the ever-increasing and expensive duplication of government work. And the remedy is expected to be found in a "boiling down" that will dispense with the superfluous.

Duplication of Government Work

Shipping and shipbuilding men have probably had comparatively little knowledge or first-hand experience with duplication of government work, because this evil has not been flagrant in their sphere. Indeed, the movement to gain better status for Uncle Sam's merchant marine annex has been prompted not so much by internal conflict or duplication of effort as by the conviction that it would be advantageous if the federal forces of the merchant marine could, at all times, have representation in the Presidential Cabinet and a voice in the councils where are formulated our national policies. But while there is little "doubling" in service of the

merchant marine, the evil has grown to flagrant proportions in other governmental quarters, as is not unnatural, perhaps, seeing as how there has been no revision of the organization chart since the government set up in business.

Statistics compiled some years ago indicated that if the United States Government was operated as a large private business is conducted there could be a saving in operating expenses approximating one million dollars a day. An estimate made a few weeks ago places at $500,000,000 per annum the saving that will be possible under a proper consolidation and elimination of governmental activities. Aside from the sheer waste that results from obvious duplications of effort, there is the further consideration that overlapping jurisdictions by many governmental agencies as now constituted has resulted in friction that in some instances has impeded progress.

Concentration of Governmental Maritime Agencies

Whether or not the joining of the whole broad issue of governmental organization results in the creation of a new executive department with the functions or structure of the Shipping Board as a nucleus, it is a foregone conclusion that the shake-up will result in a regrouping of the federal agencies that have contact with shipping. That is to say, if none of the existing agencies be absorbed or supplanted, at least there will be realinement. Every tentative plan of government reorganization that has been put forward in Congressional circles contemplates a new line-up of the maritime agencies of the government.

Assuredly there has been need for selective association, dating from the days before the Shipping Board was even thought of. No other great industry and instrumentality of public interest has had its governmental agencies so scattered and isolated. There has been effort, partially successful, to be sure, to concentrate in the Department of Commerce the institutions that deal with maritime responsibilities. In consequence, we find in this executive division the Bureau of the Census, Bureau of Standards, Bureau of Fisheries, Bureau of Lighthouses, Coast and Geodetic Survey, Bureau of Navigation and Steamboat Inspection Service. However, there is yet room for closer affiliation in the interest of interdependent efficiency, as witness the fact that Coast Guard is under the jurisdiction of the United States Treasury, the Mississippi River Commission and the Board of Engineers for Rivers and Harbors are under the War Department, the Navy Department has the Hydrographic Office, and the storm forecasting service, that is essentially for the benefit of maritime interests, is in the province of the Department of Agriculture.

Co-operation Desirable

As has been said, every tentative proposal for the readjustment of the federal administrative machinery recognizes that the interests of the merchant marine and of the nation's waterborne commerce require consistent affiliation in behalf of team-play. Thus, the programme worked out by Senator Medill McCormick, of Illinois, proposes to make of the existing Department of Commerce a comprehensive clearing house for shipping and commercial interests, and to that end would transfer to that department the Weather Bureau, the Patent Office, the Coast Guard, Hydrographic Office, Naval Observatory and the inland and coastwise waterways services now within the jurisdiction of the War Department. Another suggestion, born of the present agitation, calls for the consolidation of all the "engineering" activities under one administrative organization. The outstanding objective, however, is the reduction to a minimum of the independent bureaus of the government which have multiplied extravagantly in recent years. And it is just this aspect of the undertaking that renders it certain that question will be raised whether the Shipping Board should be allowed to preserve its individuality.

Centralization of Purchasing Power

One assured feature of the scheduled reorganization of the government will communicate its revolutionary influence widely in shipbuilding and ship supply circles. This will consist of a centralization of governmental purchasing power, in the train of which will come standardization of governmental specifications. It is stated that, as matters now stand, no less than seventy different governmental agencies have authority to requisition or purchase supplies. As many shipbuilders and marine outfitters can testify, this has resulted in confusion and a woeful lack of standardization. Also, as has been spectacularly demonstrated by recent happenings in the coal market, the condition has permitted one branch of the government to bid against another, to the demoralization of the commercial market. There is a feeling in Congress also that it would be an excellent idea if the project for a central purchasing agency could be balanced by a plan for a central salvage bureau that would undertake the orderly disposition of all surplus government property. It is claimed that with such a clearing house functioning intelligently it would be possible in many instances to divert equipment and supplies unneeded in one quarter to other federal institutions where the material could be used to advantage, thus saving money for the government and at the same time avoiding unnecessary derangement of the commercial market. This question is, of course, one that is just now acute in shipbuilding and maritime outfitting circles owing to the activities of the Shipping Board in offering for sale surplus materials of various kinds.

Economy and Efficiency

The impending reorganization of the administrative machinery of the government will not only result in greater cohesion of merchant marine activities, but, in furtherance of ideals of economy and efficiency, contemplates more compact facilities of administration. Indeed, in the discussions incident to Congressional action providing for reorganization, the Shipping Board's and Emergency Fleet Corporation's expansive offices were cited as a shining example of waste and extravagance. As an "exhibit" in proof of the charge, there has been prepared an itemized statement of the rental payments of the Shipping Board for quarters in privately owned buildings in Washington and Philadelphia.

For the office building located at 1319 F street, N. W., Washington, D. C., the Shipping Board pays an annual rental of $51,261. For the adjoining building at 1317 F street, likewise used for office purposes by the Board, there is paid annually $35,018.40. In addition to these rented buildings in Washington the Shipping Board now pays for rented quarters in Philadelphia $70,000 for the building at 329 South Broad street, used for offices, but in part subleased to other tenants; $275,000 for the building at 140 North Broad street, used for offices, but in part subleased to other tenants; $95,000 for the building at 921 Delaware avenue, subleased to other tenants, and $32,000 for the building at 253-255 North Broad street, now subleased to other tenants. Congressmen who are keen for concentration and consolidation argue that the entire staff and complete files of the Shipping Board and Emergency Fleet Corporation could be accommodated in the huge building at Washington, erected during the war to provide quarters for the temporarily expanded Navy Department, and that this removal, in addition to placing the merchant marine institution in close contact, as it should be, with the Navy Department, would stop the rental of $86,279.40 in Washington and the rentals in Philadelphia, which aggregate $472,000, and all of which would fall upon the government should the tenants who are now subleasing from the Shipping Board elect to vacate.

Retrenchment

With our eyes turned upon the financial side of the government's activities in the merchant marine field, it is fitting to

mention that Congressional effort for a shake-up in Shipping Board policies and practice will not even wait upon the reorganization that is promised in the future. A spirit of insistence that the Shipping Board shall contribute its full share to the immediate retrenchment of government expenses has been manifest in Congress this winter in connection with the making up of the governmental expense account for the fiscal year 1922. Officials of the Shipping Board have been mercilessly cross-examined by the Committee on Appropriations of the House of Representatives, which is charged with the duty of framing the "supply bills," and as a result of the inquisition the appropriations for the use of the Board will be much less than the estimates submitted to Congress for approval.

Congress has not definitely decided upon what financial basis the Shipping Board and Emergency Fleet Corporation will carry on their business during the coming year. Beginning July 1, 1921, it is probable that the plan will call for lump appropriation for a year's operations. Under this new procedure the Shipping Board called for an initial annual appropriation of $147,000,000. A considerable portion of the funds have been asked for the use of the consolidated department of construction and repair which has under construction but uncompleted a total of 95 vessels, the estimated aggregate cost of which will be $163,000,000. It is figured that to carry on the work on the vessels under construction during the first six months of 1921 will require a sum totaling $130,000,000, which expense will presumably have to be taken care of by a "deficiency appropriation." The finishing touches to the new vessels, in the period following July 1, will necessitate, it is estimated, an outlay of about $33,500,000, which would come out of the total allowance of $147,000,000 which is sought for all Shipping Board operations next year. Up to the present writing Congress has shown a disinclination to grant the above appropriation.

Estimate of Tonnage Deliveries

In this connection the Shipping Board has prepared for the use of the Congressional committee an estimate of deliveries of tonnage during the year 1921 that may be of interest to the industry. During the first half of the present calendar year deliveries are counted upon, in deadweight tons, as follows: January, 187,350; February, 114,950; March, 68,000; April, 61,900; May, 103,900, and June, 98,100. In July the expectation is for deliveries of 20,200, and in August 36,000. In September there should be deliveries of 24,000; in October a Sparrows Point delivery of 13,000, and in November a delivery of 11,000. This will leave delivery of 13,000 for January, 1922, and an equal tonnage in April of that year.

In recent conversation with members of the Appropriations Committee, Commander R. D. Gatewood, Director of Construction and Repair, has stated that construction on the government contracts is proceeding in the main "very satisfactorily" principally for the reason, he believes, that there is not a great deal of other construction going on, and in consequence of the fact that the efficiency of the construction plants is being raised all the time due to the readjustment of industrial conditions. Incidentally, this official, in discussing the sale of ships—sales having totaled 449 to date— remarked that, although sales prices have been modified twice, it might be necessary to modify the figures still further, inasmuch as the vessels "are not moving very fast." Incidentally, Commander Gatewood remarked that the expense of repairs to Shipping Board vessels is being heavily reduced. For the first half of the calendar year 1920 the repair bill averaged $6,500,000 a month. During the last half of the year the outlay was scaled down to $4,500,000 per month and the Director remarked that "they are going to get materially less."

Committeemen at the Capitol quizzed Commander Gatewood quite pointedly on the comparative cost of ship repair work in United States navy yards as compared with private yards, and he reported that the expense of work performed at navy yards is 20 percent more than the work done on a comparative basis in private yards. He attributed the discrepancy to the high overhead carried in the navy yards. By his estimate the average overhead in the navy yards is 80 to 100 percent, and to this he attributed the excess cost of navy yard repairs rather than to any lack of efficiency on the part of navy yard workmen. Asked why the Shipping Board uses the navy yards for even 5 percent of its repair work, Commander Gatewood made a significant disclosure of policy. He said:

Cost of Ship Repair Work

"It costs 20 percent more, but there is a distinct object in having repair work done in navy yards. By using the navy yards you get a somewhat better quality of work, which helps to make up for the difference in the cost from using navy yards. By using navy yards you have at all times a fully equipped plant to which you can send your vessels, if you think that the cost at private yards is excessive in any given locality, or that the quality of the work is not what it should be. The navy yards thus far have been used almost entirely as counters against excessive private yard costs."

The chairman of the Appropriations Committee was inclined to criticize this policy sharply. Pointing out that the Labor Wage Adjustment Board reported not long ago that there was a difference of at least $240 per annum between navy yard wage scales and the present wage scale of the private shipbuilding industry, he said: "Now, in order to find increased work for men who can be employed at higher wages than in any other industries in the United States, you go to work and dump several million dollars worth of additional work into the navy yards, requiring more employees and more men at a higher rate of wage than is paid to workmen in like industries. I do not see any sense in that sort of arrangement."

The Shipping Board executive defended his policy by reiterating: "The purpose of the Shipping Board in using navy yards is entirely to make it clear to private contractors whose costs are excessively high, or much higher than they should be, that we have another place to send our work on occasions if they do not want to keep the costs at a point that we think is reasonable. It would be grossly unfair for the Shipping Board to assign such a large proportion of its work to navy yards as would put the private yards out of business, or so greatly reduce the volume of the business of the private yards that they could not operate efficiently, and we have not done so to anything like that extent."

Progress of the "Isherwood System"

THE annual report on the progress of the "Isherwood system" of ship construction for 1920, contains the following table giving the number and total deadweight tonnage of Isherwood framed vessels built throughout the world each year since this system was applied to shipbuilding. While this table is confined solely to Isherwood ships, it, nevertheless, indicates the fluctuating phases in shipbuilding generally throughout the world.

	Number of Ships	Deadweight Tonnage
September, 1907 to December, 1908	6	31,608
1909	36	212,992
1910	76	484,752
1911	140	958,795
1912	240	1,777,348
1913	270	1,993,034
1914	311	2,351,322
1915	468	3,548,221
1916	620	4,666,000
1917	800	6,332,150
1918	1,050	8,707,700
1919	1,260	10,594,700
1920	1,395	11,952,400

Mold Loft Suggestions

Shell Expansion—How Practical Problems Are Worked Out on the Mold Loft Floor

BY J. I. HESS*

FROM a practical point of view there is a limit to the amount of work that can be done in the loft, though there is nothing that cannot be done with a satisfactory degree of accuracy, theoretically speaking. This limitation is due primarily to the difficulty in holding the ship fair during construction, for when completed it seldom conforms to the body plan in every detail. For this reason a template may be perfect in every respect, according to the loft, and be useless when applied to the ship. This condition is greatly aggravated by the practice of lifting various bounding bars and other connections that can be perfectly molded. If these members were supplied by the loft and used as early as possible in the course of erection, they would help to keep the ship fair and would insure a better fit in the members that are to follow. But the work must be *right*.

It sometimes happens that the loft will turn out a template with every confidence in its accuracy, and yet it may contain serious errors. This is not because the loftsman is careless or has not given the work his best efforts, but it may involve a problem in descriptive geometry that has never been called to his attention.

These oversights on the part of the loftsman are more liable to occur in the newer yards that have been working under the handicap of more or less unskilled labor. It is for this class of workman that these notes are prepared; but since the method of treatment of the various questions taken up here is entirely original, it is possible that the older and more experienced craftsman may find them of interest. To be able to follow the solutions offered one must have a fair knowledge of descriptive geometry and some trigonometry, though such knowledge is not necessary for the practical application of the results.

Shell Expansion

Perhaps the most interesting problem that confronts the loftsman is the expansion or development of the shell and other warped surfaces. With varying degrees of success every man who has worked with the lines on the floor has experimented more or less on some method of doing this work. The majority of those who have learned anything have kept it to themselves as a "trade secret." For that reason they surround the work with a great air of mystery, some loftsmen even going so far as to put in a lot of extra motions just to make it seem more difficult.

Any solution that is mathematically correct will give accurate results, if proper care is used in applying it. It must be so accurate that both inside and outside strakes can be laid out from stem to stern with absolute certainty that they will fit, provided, of course, that equal care is used in assembling on the ways. But accuracy is not the only requisite. It must be simple and rapid and easily handled. The method offered here qualifies, I believe, under these requirements.

Most loftsmen are familiar with some method of finding the true length of a line projected on the body plan, but those who are new to the work will be interested in a brief analysis of the method that seems to be the simplest and most nearly accurate.

In the portion of a body plan shown in Fig. 1, *AB* and *CD* are the lower and upper edges respectively of two outside shell plates, *"J"* and *"G."* It will be noticed that these lines locate the edges of the inside plates as well, for the width of the "skin" plates is found at any point by taking the girth of the frame at that point between the lines *AB* and *CD* and

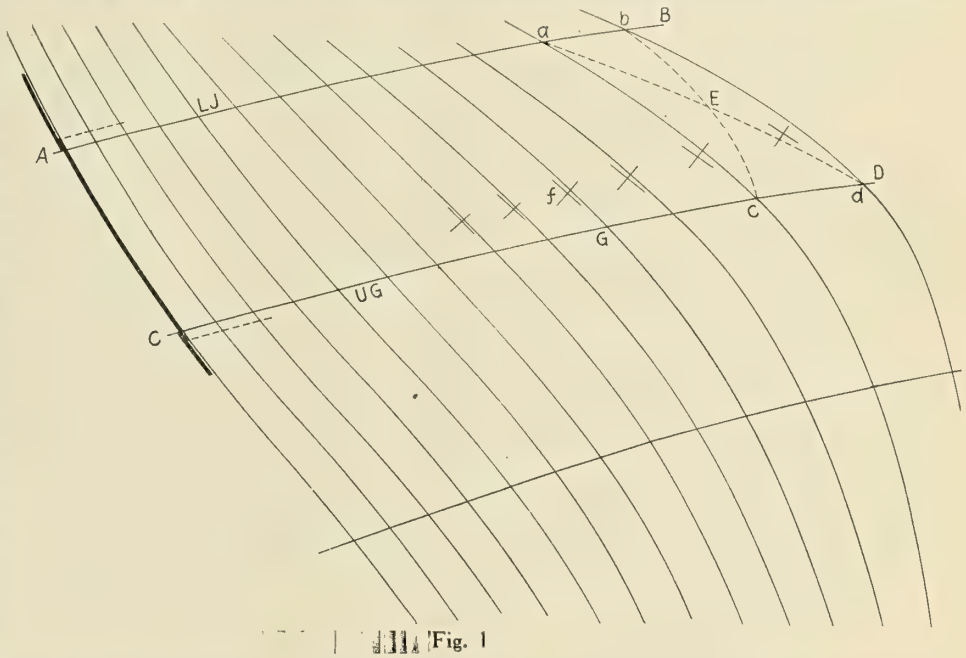


Fig. 1

adding the width of seam at top and bottom, as shown at *AC*. But that is a later consideration. The first step in the development of either the inside or the outside plate is to find the true length of the lines representing its edges. If we bend a batten along the line *CD* and pick up each frame intersection on it, these points, when measured from a common pitch mark or base on the batten, will be the ordinates of the curve made by the line *CD* on the side of the ship, or the curve that would be made if a plane were passed through *CD* perpendicular to the shell.

If the loft is not crowded, fence off a space as long as possible, and draw the frame lines on the floor with fore-and-aft spacing full scale. On these lines, and from any base as shown in Fig. 2, set up the points just lifted on the batten. The resulting curve is the true shape of the edge of the plate as it is on the ship, and a long batten bent around this curve and marked with the frame intersections gives us the true length of the line. The distances between the marks on the batten are the expanded frame spaces.

It must be remembered that the curve thus made is the molded edge of the plate, or a line on the heel of the frames. After the points are located on the floor, select two battens approximating the thickness of the inside and the outside

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plates—say 5/8-inch—and pin them on the floor side by side, as shown in Fig. 2, so that the inside edge of the batten representing the inside plate is on the points, or molded line. (If the curvature is very great, the thickness of the battens is important.) Square up and across as shown. These battens, when straightened out, give us the required lengths of the inside and the outside strakes on the line *CD*.

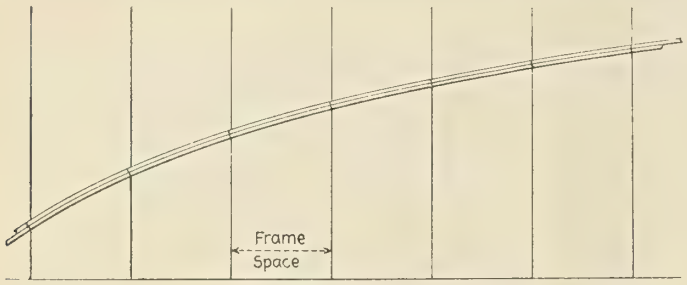

Fig. 2

You will notice that the outside batten is a little longer than the one on the inside, due to its greater radius of curvature—a detail usually overlooked.

If the facilities of the loft permit, it will be found advantageous to run this line from the midship section clear through to the stem—or the stern as the case may be—at one operation. Develop each "sight edge" the same way. Number the frames and label the battens so there can be no confusion; tie them in bundles for each strake and pot them in the racks for future use. (In some cases, one may even go farther and space in the seam holes while the battens are on the floor, but I have found it more convenient to keep a record of the seam holes on a special batten lifted from the template of the inside strake. If a double riveted seam is used, cut a batten the proper width to fit in between the gage lines and pick up the holes on each edge of the strip. Don't forget to transfer the molded lines of the frames to it also, for in applying it to the outside strake it will be found necessary to move the strip ahead occasionally to make up for the difference in length.)

Again let us consider a portion of the body plan, Fig. 3. Let *AC* and *BD* be two adjacent frames, and *AB* and *CD* the top and bottom edges, respectively, of the shell plate

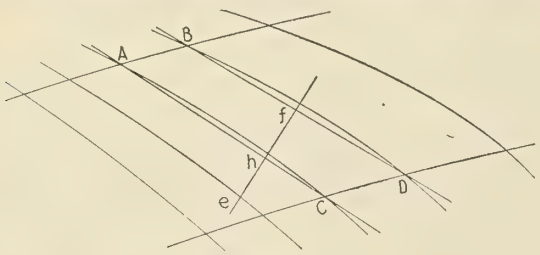

Fig. 3

under consideration. From the theory of the body plan, we know that the two frames each lie in a plane that is parallel to the plane of projection—body plan—and separated from each other the distance of one frame space. Draw the straight lines *AC* and *BD* through the intersections of the frames and the edges of the plate. Since the points *A* and *C* both lie in the same frame, the straight line *AC* must lie in the plane of the frame and be parallel to the plane of projection. Hence, if we draw any line, *ef*, perpendicular to *AC*, its projection on this plane (body plan) will always be perpendicular to *AC* no matter what its inclination to the plane of projection (bevel). In other words, if we pass a plane through *AC* and *ef*, and use *AC* as an axis of rotation, the points *e* and *f* will move along the perpendicular line *ef*, and when this plane stands perpendicular to the plane of the body plan, the points *e* and *f* will coincide in the point *h*.

To simplify the explanation further, let us assume that the frames are represented by the straight lines *AC* and *BD*. If one end of the shell plate be fixed at the frame *AC*, and the plate unwrapped from the side of the ship until it lies in a plane parallel to that of the body plan, the frame *BD* will be seen to move away from the frame *AC*, until the distance between them is that of the expanded frame space. Since

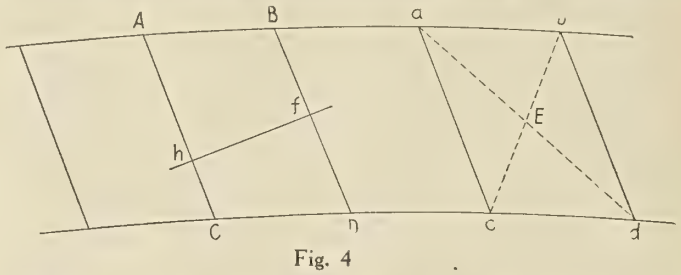

Fig. 4

the point *f* must always lie in the line *ef*, the intersection on *BD* is fixed and must be the same on the developed plate as on the body plan. That is, if Fig. 4 represents a portion of the developed plate, *Ch* and *Df* in Fig. 4, must equal *Ch* and *Df*, respectively, in Fig. 3.

It makes no difference where the line *ef* crosses *AC*. It may be either sight edge, or any other convenient point in between, but for various reasons it is easier to handle if the point be chosen, so that the line squared ahead will intersect the next frame within the edges of the plate.

Construct a "square" of any suitable material—hard wood is preferable—about the dimensions shown in Fig. 5, with all joints mortised in so that it will lie flat on the floor. The arm *AB* should be long enough to span the widest plate to be encountered. The upper edge of *AB*, and the right hand edge of *CE*, should be as nearly unobstructed as possible, for these are the working edges. It will be noted that the arm *ED* serves no purpose, but to help hold the arm *AE* straight and rigid. If it be possible to get a square made of light steel, this arm and brace may be eliminated. It must be as nearly square as possible, for, if not, the error will be accumulative and may result in disaster. To guard against this, check its

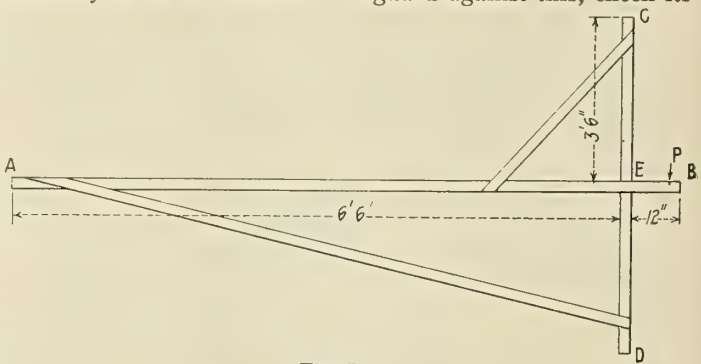

Fig. 5

accuracy occasionally, for even the most carefully constructed square may warp a little.

Select any pitch mark *P* on the arm *EB*, and use this throughout the process of development. The only thing that determines its location is: the arm *CE* should intersect the next frame within the edges of the plate as before stated. Lay the square on the body plan with the arm *AB* through the intersections of the frame and the edges of the plate and with the pitch mark *P* on one edge. (It doesn't matter on which edge the pitch mark is placed, for the result is the same, whether the squaring process is done toward the stem or toward the stern. Only it must be remembered that later, when the work of development begins, the same edge must be used and the work carried out in the same direction as laid out on the body plan.) Mark along the arm *CE* on the floor at about the place where the arm *AB* will be in its next

position. Move the square ahead to the next frame and mark along the arm *AB* to intersect the line just drawn; then mark along the arm *CE* and repeat the process. When the work is completed, the body plan will show a series of small crosses as shown in Fig. 1.

In the case of an outside plate with considerable curvature in the frames, it may be found advisable in a few instances to square out a distance of one and one-half times the thickness of the plate from the molded line to the neutral axis of the plate for points on which to apply the square. If the plate is clinker construction, or with one edge in and one out, it must be treated accordingly. That is, one end of the square will be applied to a point squared out from the molded line a distance equal to the thickness of the inside plate. Theoretically, one should in all cases work from the neutral axis of the plate, but the results obtained are not commensurate with the work required. Numerous tests have shown that except for the cases noted above the results are almost identical with those obtained when working from the molded line. This is more easily understood when it is remembered that we are working from a straight line between the edges of the plate. The curvature of the frames is taken care of with the girth battens.

Select several very thin battens about as wide as the thickness of the plate and long enough, when bent around the frames, to span the plate. (The width of these battens is important.) If it is an inside, or skin plate, bend the batten with its inside edge on the molded line. But if it is an outside plate and there is much curvature in the frame, the girth measured will not be right unless the batten is moved out from the molded line, the proper distance to allow for the inside plate and liner.

While the batten is bent in this position, transfer to it the two sight edges and the heel of any longitudinal, stringer or deck bar that may be shown. Release the batten from the floor. Hold the sight edge on which the pitch mark of the square was applied and, with the batten *straight,* pick up the point of the cross. This distance corresponds to *Gf* in Fig. 1. Move the batten to the next frame and repeat, being sure to hold the same sight edge each time—the one on which the pitch mark of the square was applied—so that the variation in the girths will all fall on one end of the batten. The marks must be distinctly numbered to avoid confusion. If they become too close to permit this, take a new strip. This will give us all the data necessary to lay down the outline of the plate.

Select from the rack the two long battens representing the edges of the strake desired. Tack one end of each to the floor, properly spaced from each other with the girth batten for that particular frame. Move the girth batten ahead to the next frame and lightly tack the end with the pitch mark in place, leaving the other end free. Now place the square on the frame just fastened to the floor, with its pitch mark on the edge batten. Be sure that the pitch mark on both the square and the girth batten is applied on the same edge that was used on the body plan. Move the edge batten at the point where the girth batten is fastened to it, until the proper point on the girth batten falls under the arm *CE* of the square, then fasten it to the floor. Space the other edge batten to give the proper girth and tack it to the floor also. Move the square and girth batten ahead and repeat. A loftsman and helper, standing facing each other, one handling the square and the other the girth batten, can do a surprising amount of work in a short time.

When the strake is tacked to the floor, it is time to check for errors. If the work is carefully done, the chance of serious error is slight, but there is a lot of satisfaction in knowing that any such error can be determined with absolute certainty. If the double diagonals, *ad* and *cb,* in Fig. 4 are checked at each end of the strake and in the middle and found correct, it is safe to assume that the work as a whole is correct.

On the body plan, as in Fig. 1, the projections of the diagonals will not be straight lines but will be curved as shown by *ad* and *cb*. Geometry teaches us that the diagonals of a parallelogram meet in a point that is equidistant from the opposite sides. The surface under consideration is not a true parallelogram, but from frame to frame the approximation is close enough for all practical purposes. Hence, with the point *E* located midway between the sides, it is only necessary to bend a batten through the three points to get the projection of the diagonal. Pick up the girths of these diagonals as was done with the frames. Lay these lengths off on the leg of a right triangle, the other leg of which is one frame space, and the resulting hypothenuses

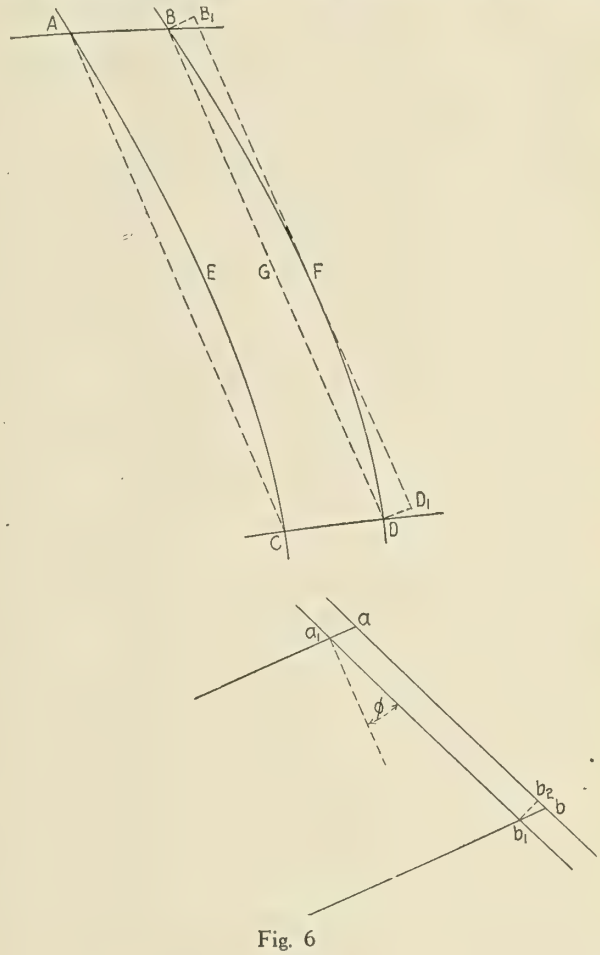

Fig. 6

will be the developed length of the various diagonals and should fit the developed plate. If there is much curve in the plate, a slight error will creep in here, due to the fore-and-aft curvature of the diagonal not shown on the body plan. However, it is so slight as to be negligible.

Having proved that the development is correct, it remains only to draw in the frame lines and build the templates. Much time will be saved in making the templates, if the edge battens are so placed that the working edges are on the inside for an outside plate and on the outside for an inside plate. This will allow the templates to be built right over the battens without having to take them from the floor and it saves the time of transferring the points and lines to the floor and the danger of confusion later.

If there is any noticeable curve in the molded frame, and appreciable bevel, the frame will not cross the developed plate in a straight line but will curve in the same direction as is shown on the body plan. That is, if on the body plan the curve is convex toward midships, or toward the "wall," the curve will be convex toward midships on the developed plate. This deviation from a straight line is determined as follows:

In Fig. 6, let AC and BD be sections of two adjacent frames, AB the upper edge and CD the lower edge of the shell plate under consideration, as before. Draw the straight lines AC and BD. Now let us take a projection of this figure in a plane that is perpendicular to BD; then B and D fall in the point b_1 and F falls at b. For the purposes of this demonstration, we may assume AC to be parallel to BD and treat it similarly. This gives us, then, a view of the plate in which the line a_1b_1 is a projection of both the top and the bottom edges, and ab is a line through the extreme outside of the curve, or the approximate center of the plate. The frame's variation from a straight line on the body plan is shown in the vertical projection by the distance FG, and in the horizontal projection by b_1b.

Suppose we consider ab a fixed line around which the upper and lower edges of the plate must move in order to give it the flat shape it has when developed. It will be seen that in this operation B moves to B_1 and D to D_1. Also, b_1 moves to b_2 and travels in a line that is *perpendicular to* ab. By a simple rule of descriptive geometry, this line b_1b_2 must be a straight line on the developed plate.

This shows us that for a frame to be straight on the expanded plate, one of the following conditions must exist: either the frame itself is straight, or it has no bevel. If the frame is curved and has no bevel, as in the bilge amidship, b_1b coincides with b_1b_2, and is perpendicular to ab, hence develops into a straight line. If there is bevel and the frame is straight, then b_1 and b_2 coincide with b and the developed frame is a straight line.

Since the line that develops straight on the plate must be perpendicular to ab, any other line such as b_1b will vary from this straight line the distance bb_2 at its point of greatest curvature. (With a constant curve in the frame on the body plan, this distance varies with the sine of the angle of bevel. If the bevel of the frame is constant, then this distance bb_2 varies directly with the amount of curve bb in the frame line on the body plan.)

The writer has devised an instrument, shown in Fig. 7, for applying this principle in practice. It is built of light wood and all joints are mortised in so as to be flush on both sides. This allows the instrument to lie flat on the floor with no interruption to the free swing of the arm BG. AB is a straight edge, long enough to span the widest plate shown on the body plan, and made at right angles to the scale DF, which is laid off in inches with the graduations on the upper edge. This makes it possible to measure the hypothenuse of the right-angled triangle made by the small movable square, as shown at b_1b. CD is also a scale in inches, about 8 inches or 10 inches long, with the zero end at C, but with the graduations on the lower edge, to be used in measuring distances on the floor. The movable arm BG is pivoted at B, which point is at a distance of one frame space from the scale DF. In case there are several spacings used, it is a simple matter to have a movable pin at B, with holes spaced as desired, in which to slip it. Great accuracy in this respect is not necessary. This arm BG supports on its movable end a sliding square with a scale about three inches long on its short leg with the zero end at the apex of the angle. The other leg should be not less than 8 inches long, both legs being beveled as shown for convenience in reading the scales. It will be noticed that the arm BG is made with an offset. This should be just enough so that a line through the edge of the scale bb_2 extended will pass through the point B. An offset is also made on the inner edge of the straight edge AB at E, which is the apex of the right angle BEF.

In comparing Fig. 7 with Fig. 6, it is seen that the arm BG in Fig. 8 takes the place of the line ab in Fig. 6, and that the movable square duplicates the conditions shown in the small triangle bb_1b_2.

The application of this instrument to the floor is not only accurate and easily done but it is quick and entirely does away with the more tedious methods formerly employed. To use, place the straight edge through the points B and D, Fig. 6, and read the curvature GF on the scale CD. The point of greatest curvature is usually the approximate center of the plate and this point is more easily and quickly found, if a series of distinguishing marks are spaced equidistantly on each side of C as shown. Now move the instrument so that the point E falls on the frame line, with DF perpendicular to it, and move the arm G out to the next frame. The

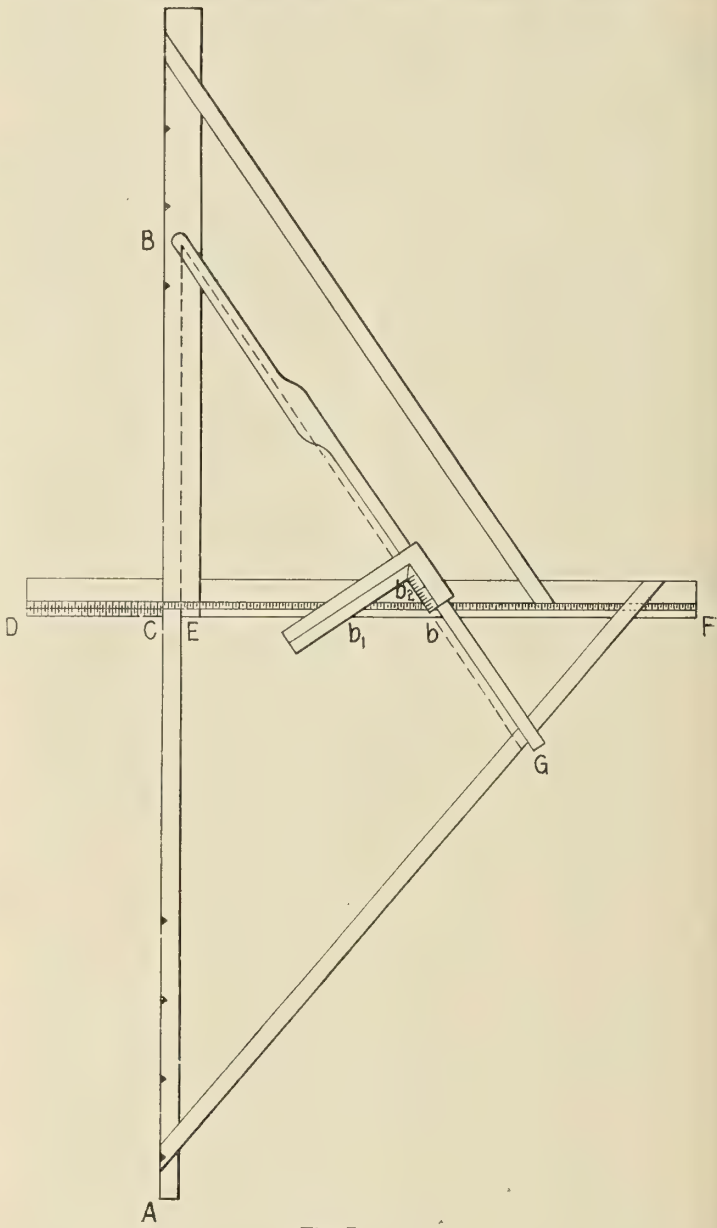

Fig. 7

angle EBG then represents the bevel of the frame at that point. Slip the small square along the arm until the reading bb_1 on the scale DF equals the amount of the curvature just read at GF, Fig. 6. The intercept on the scale, bb_2 will be the required curvature on the expanded plate.

Unless the curvature or the bevel of the frames is changing rapidly, it will be found necessary to take only each fifth frame. The difference can be divided evenly between the others. When a list of these measurements is made, the instrument is carried to the development work and the points spotted in by means of the straight edge and the scale CD. A batten bent through each group of three points gives the heel of frame—but be sure that the curve is in the right direction as previously directed.

(To be continued.)

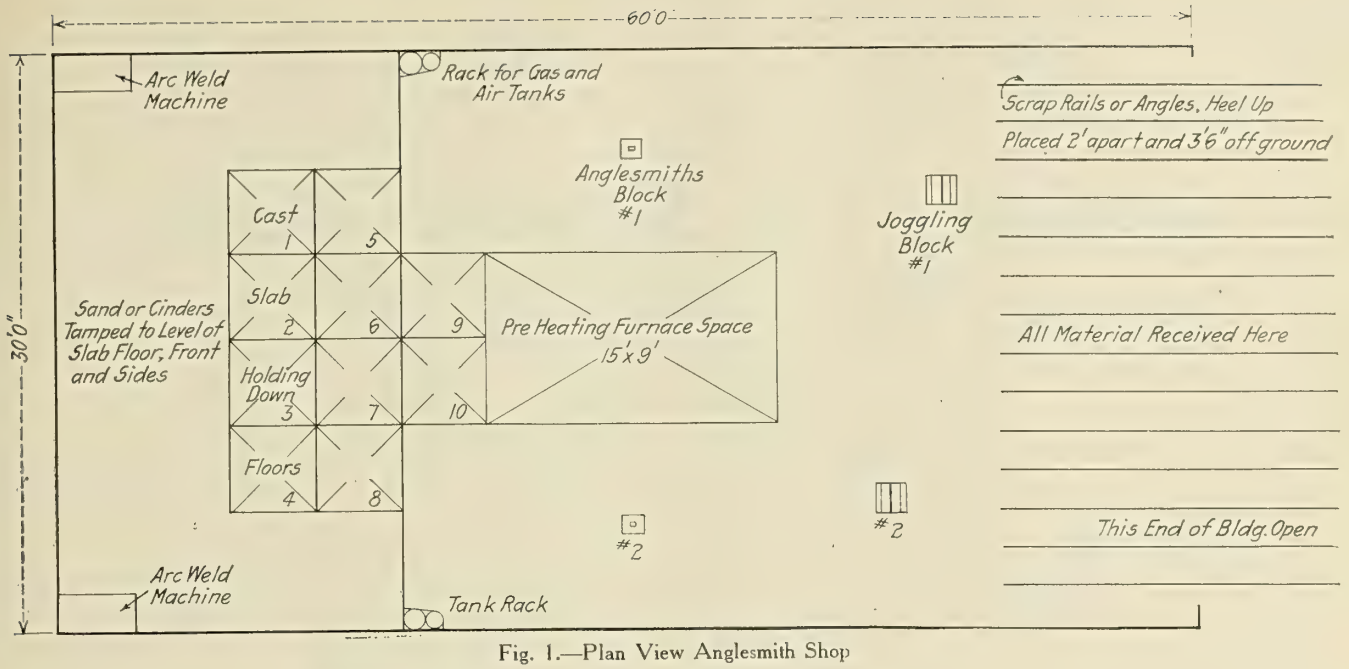

Fig. 1.—Plan View Anglesmith Shop

Modern Anglesmithing

Arrangement of Angle Shop—Typical Methods of Making Inside and Outside Bends by Means of Welding Apparatus

BY MAURICE NICHOLLS*

THE logical treatment of anglesmithing falls in two divisions: first, a shop and equipment section, and, second, a study of modern methods.

Fig. 1 shows the ground floor plan of a shop that will handle the angle work of five to eight vessels at one time. It should be noted that no old-fashioned coal burning angle forges are installed. The coal forge has faithfully served the shipbuilding industry since the day of the first iron ships, but now it must be set aside in favor of the speedier, cleaner and more modern devices, the most important of which are the electric arc, gas cutting and heating.

The building should be of light material, whitewashed on the inside. An ordinary tamped cinder floor answers the purpose very well. The building and equipment are arranged for a direct flow of material through progressive stages of fabrication, i. e., material is received at one end and the finished product turned out at the other, thus avoiding shuttling while in the shop.

Arrangement of Joggling Blocks

In view of the fact that many yards do not use angle joggling machines, the work naturally comes to the angle shop. The joggling blocks are arranged out of line so that two long bars may be handled at the same time. Gas and air tanks are located at either side to accommodate these blocks. These tanks are housed so that they may be replaced from outside the building when empty, thus eliminating lost time by carrying tanks around and over the work.

Next in line are the anglesmiths' blocks arranged one on either side and served by the gas tanks installed at the sides of the shop. It will be noted that there is a space allotted for a preheating furnace, which is to be used in connection with the welding of castings, as it avoids the use of charcoal and the construction of a temporary furnace. Castings may be returned to this furnace, which is then allowed to cool. The slow cooling of the castings in the furnace results in well annealed material. If this is not desired, good results in preheating can be obtained on the slab floor with charcoal, by placing an air connection under the slab.

The slab holding-down floors are provided for beveling small clips and parts of shoes that take the contour of the shell where this work is too heavy to be done by acetylene heating. At the sides and front of the slab gratings is a cinder floor level with the gratings, to be used for welding the cuts and filling-in pieces. This makes the best flooring for this type of work, as it prevents the metal from sticking during the welding process. Arc welding machines are located at this end of the building, one at either side.

The length of the building is spanned by two overhead cranes, the center of each being over the anglesmith blocks. Each crane is provided with a 4-ton hoist.

Welding Equipment

Any standard type of arc welding machine is suitable for the electric welding of angle work. There are so many different sorts of gas welding and burning outfits that no special make will be recommended. It is advisable, however, to have two complete sets of gas tanks, one to be connected to a burning torch and one to be connected to a heating and welding torch. This can be worked out with the desired combination, according to the work to be performed, and will save the time usually lost by changing tips.

Making an Outside Bend

As seen in Figs. 2 to 8, the general procedure for doing angle work with the aid of gas welding is exactly the same as for coke fire work. In the first operation of making a right angle outside bend, Fig. 2, the burning torch should be held at an angle and then reversed to the other side and worked back. This gives the cut a V-shape and requires only light chipping to clean it for welding. The angle is then placed on the anglesmith's block and heated as indicated for bending.

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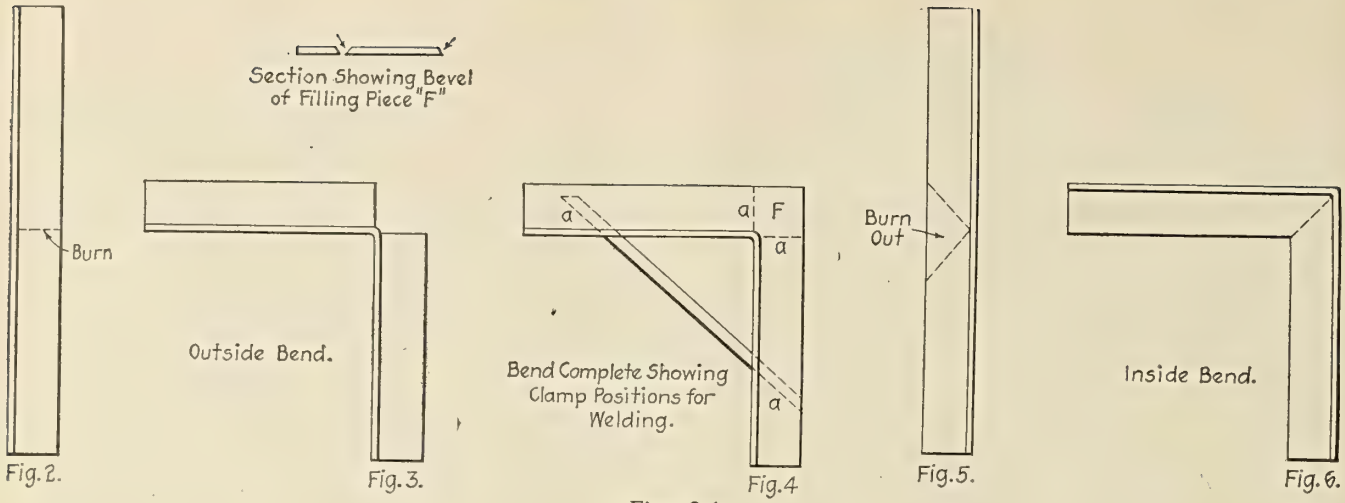


Figs. 2-6

It is interesting to note that angles up to 6 inches by 6 inches may be bent very easily through 90 degrees by heating a space not over 1½ inches in width. Fig. 3 shows the angle bent to shape.

After the bar has cooled, the filling piece is fitted and the angle is braced with a ¼-inch by 1-inch flat bar and clamped at position *a* (see Fig. 4). It is always advisable to brace bent work in this manner, as the heat developed by welding the filling pieces will throw the work out of line. The filling piece *F*, Fig. 4, is beveled as indicated, to meet the bevel on the angle. The bar can be unclamped after the work has set and the welds along the filling piece smoothed out.

For any square or rectangular bounding bar the same procedure is followed several times. The work can be laid out complete, and if two heaters are used it is a simple matter to make two bends at the same time on the slab floor.

Steps in Making an Inside Bend

Fig. 5 shows an angle laid out for an inside bend, and, as in the first case, the torch should be held on the two cuts, so as to form a V when the bend is complete. Bends of this sort should be braced as shown in Fig. 4. The variations of the inside and outside bend are too numerous to mention and the extent of their application is limited only by the ingenuity of the man in charge.

Figs. 7, 8 and 9 show various stages in the construction of a sump well, bilge well, or drain pot, as it is variously called. The welded job is not only lighter than a casting, but is made at a third the expense and with a considerable saving in weight. Welds made by gas heating and bending are completed in about the same time as required to make the pattern for a casting. It is never necessary to heat the line of bend more than 1½ inches in width. Table I shows the approximate time required to make up angles by welding and the estimated time under the old way:

TABLE I

Size Angle, Inches	Time, Minutes	Time with Old Method, Minutes
Outside Bend		
3 by 3	3	10
4 by 3	4	15
5 by 5	5	20
6 by 6	8	28
Inside Bend		
3 by 3	3.5	13
4 by 3	4.5	13
5 by 5	7.0	24
6 by 6	9.5	33

The data given in Table I are not for light weight or heavy angles in the above sizes, but are averages taken from numerous lists of various weights.

All of the filling pieces are arc welded. The superiority of the arc weld over the torch cannot be disputed in this line of work.

The number of men necessary to do this work is the same as when coke fires were used, namely, the anglesmith and two strikers or helpers. Three helpers are necessary where long bars are to be worked. At least one, and preferably both, of the strikers should be second class burners. From actual

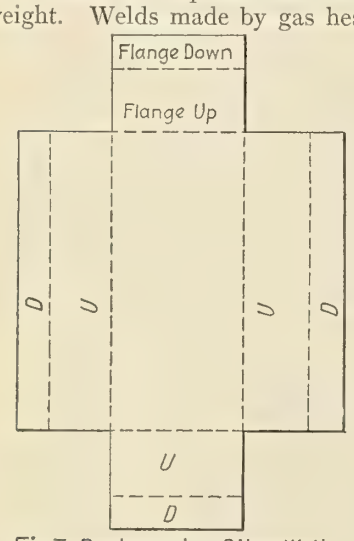


Fig. 7-Rectangular Bilge Well Laid Out.

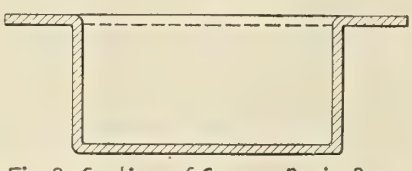


Fig. 8-Section of Square Drain Box.

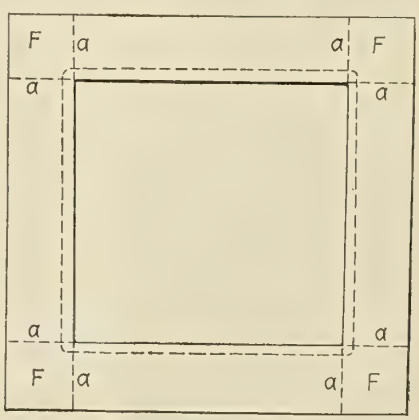


Fig. 9-Square Drain Box.

Figs. 7-9

experience, two crews of this sort were able to keep ahead of a five-vessel (3,500-ton type) construction programme. In fact, two crews were only used for part of the time. For arc welding the filling pieces, two machines are provided. One machine is sufficient to keep up the work completed by the anglesmith; the other is intended primarily for welding skylights, light tanks, ladders, etc., which are assembled close to the angle shop.

Random Notes by an Old Seaman

The Shape of a Vessel's Stern and Design of the After Body—Rudders and Rudder Design

BY CAPTAIN R. E. BARRY

SOME twenty years ago Mr. Worthly designed for Alfred Holt some 8,000-ton steamers with a new type of stern. Forgings were eliminated except for the upper part of the rudder stock and about ten tons in weight saved (see Fig. 1).

This form of stern soon became popular, although the builders forgot the reason of its design and fitted heavy forged

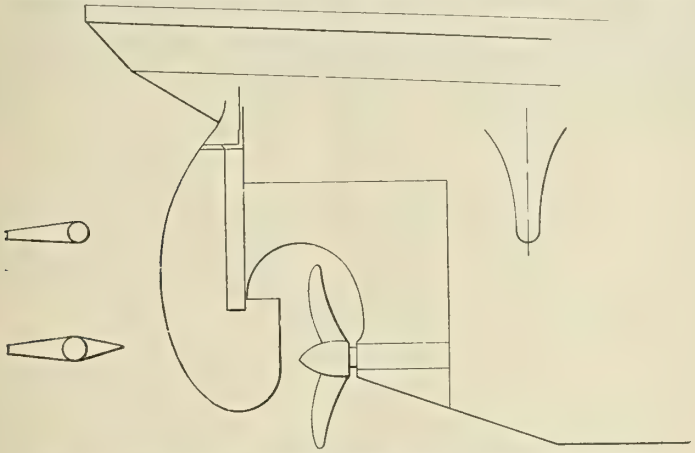


Fig. 1.—Special Type of Stern With Heavy Forgings Eliminated

stern frames. Even today the same general outline is seen on many of the large twin screw vessels.

In Figs. 2 and 3 are shown sterns of type vessels built for two large steamship companies. Figs. 4 and 5 show typical endings of sailing vessels—Fig. 4 a noted square rigger and Fig. 5 a large schooner.

The type shown in Fig. 3 steers very badly, the wake is sinuous, varying from two points on one quarter to two on the other. This ship will not steer under six knots at all if the screws are stopped, and indifferently if moving. It is customary for her to come up the bay relying on twin screws for steering with the helm amidships. Fig. 2 steers a little better. Fig. 4, when loaded, steers remarkably well with very little helm being needed at any time. Fig. 5 is typical of a number of very large wooden schooners and steers well loaded or light.

The Cut Away Stern

It is probable that the cut away stern on merchant vessels is a reflection of the naval practice in this matter, but the requirements of the two services are radically different. The naval vessel must have a small tactical diameter for maneuvering purposes, while the merchant vessel should steer as straight a course as possible. The initial moment about the pivoting point on the naval vessel when the deadwood is much cut away cannot compare with that of the narrow rudder of the old type sailing ship, but when once started it will swing much faster and pivot on a point much farther forward.

Rudders

Many tests have been made at tanks on the pressures on rudders and on the location of center of pressure, but most of these tests have been independent of the hull. While this system gives formulae for torque, etc., it is almost useless as a measure of steering qualities of a ship.

The narrow thick rudder on the sailing vessel would steer when the way on a vessel was imperceptible and only small angles of helm were ordinarily used. But in the modern cut

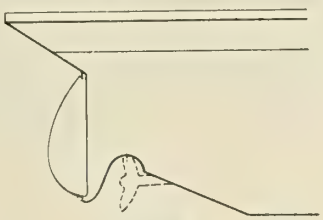


Fig. 2

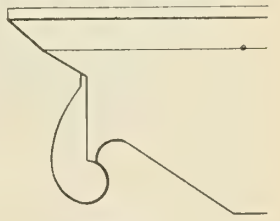


Fig. 3

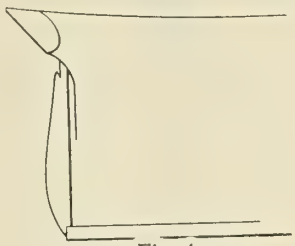


Fig. 4

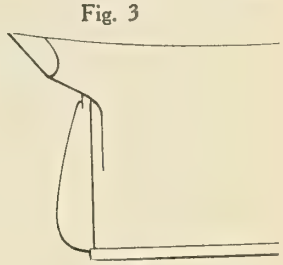


Fig. 5

away stern steamer the steering engine is in almost constant motion and the excessive helm is noted in the engine room by the reduction in revolutions of the main engines.

Single screw steamers with large screw apertures (many of the old American boats had an aperture reaching to the tuck line) would pay no attention to the helm when the machinery was stopped, swinging all around the compass despite the attempt to maneuver the vessel under sail.

All of which leads to the conclusion that the steering of a vessel depends less on the actual transverse pressure on the

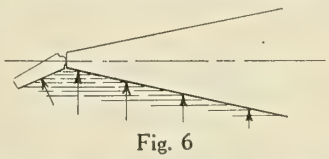


Fig. 6

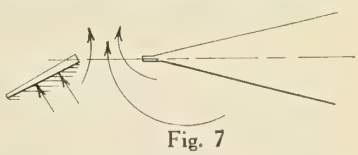


Fig. 7

rudder than on the lateral pressure of the mass of water banked up along the run forward of the rudder. Figs. 6 and 7 show the conditions in the two types. Fig. 6 would steer when way was imperceptible and Fig. 7 not under five knots.

A case which proved this absolutely was a French cruiser with a balanced rudder as shown in Figs. 8 and 9. Here the vessel's head went to the same side as the helm was forced, showing that the banked up pressure on the side was greater than on the rudder. When the balance was cut off the rudder and the aperture plated up, the vessels steered very satisfactorily.

With naval vessels economy is not a paramount matter and it is necessarily sacrificed to maneuvering ability, but in the

merchant service, with the sharp competition which we may expect in the near future, it behooves us to build vessels that will not increase the distances steamed by sinuous courses or throw extra work on the main engines by constantly blocking the screw race with the rudder, to say nothing of the energy consumed by the steering gear.

Late vessels of the Anchor Line and of the Union Castle

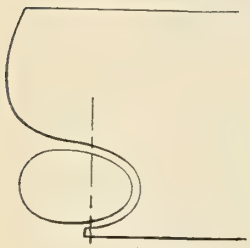


Fig. 8

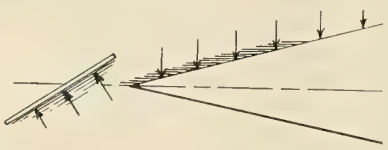


Fig. 9

Line have the solid deadwood with no aperture whatever and consequently will steer well.

Rudder Design

It often seems as if well-known truths are forgotten in a maze of technical calculations, and the type of rudders fitted to many of our recent single screw steamers exemplify this. In the old days it was a matter of experience that the whirling water of the race had more effect on the lower half of the rudder than on the upper half. Therefore, all rudders of single screw steamers were designed with the center of lateral resistance well above the center of the propeller.

The pear-shaped type will allow the helm to be carried amidships on a straight course, while the rectangular type as recently fitted will require four or five degrees of helm all the time; that is, the lower part of rudder must swing with the lower half of race whirl.

But sometimes one sees the pear-shaped rudder on a twin screw vessel. Here it is not nearly as efficient as the rec-

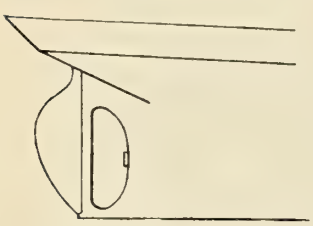


Fig. 10

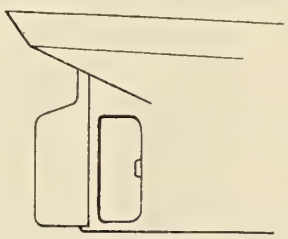


Fig. 11

tangular rudder, especially with out-turning propellers, and merely gives more surface for wave action.

Design of the After End of Hulls

In the design of the after end of hulls there has been a tendency towards very fine waterlines below with full load lines, giving a pronounced V-section, which not only makes stowage aft difficult, but greatly reduces the lateral resistance to distortion. One large single screw steamer of this type on the Pacific coast broke four shafts at short intervals after being put in service. She was excessively fine in the run. Finally a flexible coupling was fitted forward of the tail shaft and there has been no trouble since.

One model recently tested with a pronounced U-section aft gave less resistance than an equal displacement model with the V-section.

Some vessels have been built so fine aft that each plate had to be riveted up in turn as it was put in place, because if bolted up complete there would be no access to the rivet heads. Again, as it is impossible to clean in these narrow spaces, it is customary to fill with cement. Why carry useless weight?

In one China trader the after hold was so much V-shaped that a platform was built about five feet above the keelson.

A few years ago a fad to cut away the fore foot was carried to extremes. Admiral Taylor proved that the U-section forward was desirable for speed and uses it even in battleships where a few years ago they were much cut away for maneuvering purposes.

Another little point and I have done. Many mail boats today with high freeboard have little sheer and often two or three tiers of deck houses aft. The result in a beam wind is that they carry weather helm due to the center of effort being so far aft. If a forecastle head had balanced the after houses they would need less helm, so waste less energy. Also in many shelter deck type steamers the bow is so low that in any sea it is dangerous to go forward. A short forecastle head would have made them much more comfortable.

Foreign Trade With Colombia

COLOMBIA has been enjoying a remarkable period of prosperity the last three or four years, based largely upon her exceptional coffee crops. These have averaged considerably more than 1,000,000 sacks annually, and last year reached the unprecedented figure of 1,500,000 sacks. In the American markets it has commanded a constantly advancing price.

Development is also being made of her coal and oil fields and her iron industry is already fairly well established. Particular attention is being given the manufacture of agricultural and mining machinery, but by reason of the inexperience of the labor obtainable there is still an excellent opportunity for American competition in these lines, the standard of the local product not being the highest.

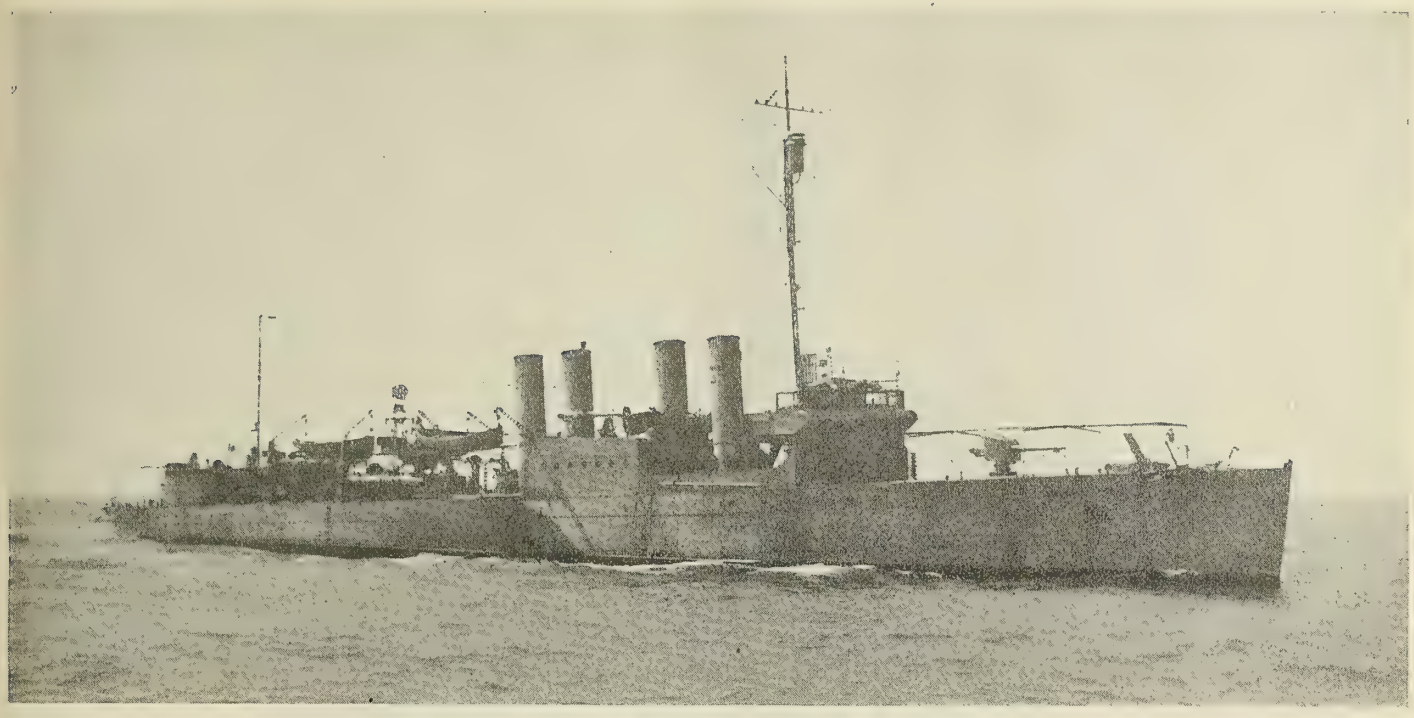
America profited principally through the war period interruption of foreign supplies. The armistice saw the warehouses of Medellin, the trading center of the country, utterly depleted of European goods. Enterprising American firms had made the most of the opportunity, and with the close and friendly relations established will doubtless be able to retain the advantage they have gained.

Just how completely American exports have dominated the Medellin markets the last two years is emphasized in a statement recently issued by the United States Department of Commerce showing that of wide range of imports the United States had supplied the following percentages:

Textiles	60	Typewriters	100
Hardware	100	Musical instruments	100
Steel products	100	Hats (felt)	40
Chemicals	100	Men's wear	90
Medicines	90	Women's fancy wear	75
Paper products	100	Toilet articles	80
Machinery	100	Shoes	100
Kitchenware	100	Jewelry	40
Tools, etc.	100	China dishes	100
Dyes	100		

One of the important influences to this end was the establishment of branches in Colombia by several leading banking institutions of the East. Through these the transaction of business has been greatly expedited and the mutual friendship and understanding of the contracting parties materially increased. Lack of similar adequate banking facilities is one of our greatest handicaps in others of the Latin American group of countries.

Marine Electrical Engineering.—A joint meeting of the Metropolitan section of the American Society of Mechanical Engineers and the New York section of the American Institute of Electrical Engineers was held in New York on January 28, to discuss the subject of marine electrical engineering. Papers were read on electric ship propulsion, electricity applied to ship auxiliaries and electrical terminal facilities.



United States Torpedo Boat Destroyer of the *Kane* Type

American Destroyer Hits Mine in the Baltic

After End of Ship Bent Bodily to Starboard—Damage Chiefly Above Waterline—Vessel Towed to Repair Yard

BY COMMANDER E. S. LAND, C. C., U. S. N.*

THAT peace has its naval difficulties as well as war is typified by the accident to the U. S. S. *Kane*, on October 1, 1920, when this American destroyer hit a floating mine in the Baltic just outside the Gulf of Riga. The *Kane* was well clear of the mine fields and no difficulties with regard to mines were expected, although an extremely careful watch was kept, as is customary in these waters. Fortunately, there were no casualties to the personnel, although the violence of the explosion caused minor injuries to three of the crew as they were hurled against bulkheads and stanchions.

The remarkable part of the damage to the *Kane,* is that most of the force of the explosion took effect at and above the waterline. To attempt to follow out the relations of cause and effect in a mine explosion is a good deal like deciphering Egyptian hieroglyphics. In this connection, attention is particularly invited to the damage to the 4-inch gun mount.

Principal Dimensions of the Vessel

The *Kane* is 314 feet long overall, with 176 frames spaced 21 inches apart. Her beam is 39 feet 10½ inches; draft, 9 feet 4 inches; and her full load displacement, 1,300 tons.

The explosion occurred off the port quarter. There is strong circumstantial evidence that one of the port propeller blades struck a mine floating just below the surface, as the leading edge of the blade was crushed to a depth of from ¼ to ½ inch, for a distance of 14 to 18 inches.

The after end of the ship was apparently bent bodily to starboard, bending showing up throughout the girth of the ship from frames 141 to 143, i. e., about 65 feet from the stern of the vessel. This bending included, to a greater or less degree, both lines of shafting, particularly the port shafting, as the port engine could be turned over only with much chattering of the gears and heavy vibration of the ship. The starboard engine could be turned over up to one hundred revolutions per minute, but this caused considerable chattering of the gears and very marked vibration of the ship. This springing of the shafts occurred in the tail shafts; the port stern shaft (the section of the shaft just forward of the tail shaft) was bent.

The bearings and couplings connecting the engine shaft and stern shaft were not damaged. The steering gear and rudder were first thought to be badly damaged, but afterwards found to function reasonably satisfactorily. The main and auxiliary machinery were not damaged to any appreciable extent.

Structural Damage

The main deck starboard stringer was buckled to a depth of four inches between frames 141 and 142; the stringer angle was broken between frames 141 and 142; the buckling was carried across the deck between frames 142 and 143; the main deck stringer plate, on the port side, was buckled at frame 142, the depth of the buckle on the port side was about 2½ inches. The starboard stringer plate was torn for about 2 inches at the outboard edge and one rivet was gone. This was the only tear in the plating.

The starboard side plating was buckled at the top strake between frames 141 and 142, running diagonally aft to 143 on the waterline. The frames, brackets, and bounding bars were buckled and bent inboard of the buckled plating from the main deck to the garboard strake. One air port lens was broken and its frame distorted. The deck plating adjoining the port stringer plate had hair cracks in it; otherwise

*Naval Attaché, American Embassy, London.

there were no cracks or holes in any of the deck plating.

The side plating on the port side had a buckle about 1½ inches deep in the top strake of the plating between frames 142 and 143; the two top strakes were also badly buckled from frame 165 to 172, the third strake of plating from the top was slightly buckled. The stringer plate on top was bent and buckled slightly, from frames 165 to 172. This buckling between frames 141 and 143 occurred in the decks and steel structure inside the ship as well as in the side plating and top side.

Propeller Guards

Three after sections of the port propeller guard were gone and two forward sections were damaged. The second strake of plating from the main deck was slightly buckled over the port strut.

Crew Space

Compartment D-204 on the first platform deck was buckled all the way across just forward of frame 142, to a depth of about 3 inches. There were small buckles at frame 144 on the starboard side only.

Magazines

Compartment D-108-M sprung a small leak on the port side between frames 141 and 142 directly under the shaft. The bulkhead between D-107-M and D-108-M buckled between frames 141 and 142. Compartment D-107-M sprung a leak between frames 141 and 142, directly under the shaft as well as in the garboard strake on the starboard side between frames 141 and 142; this strake was buckled slightly to a depth of from 1 to 2 inches. Compartment D-109-M had its side plating badly buckled between frames 143 and 144; a small hole was torn in the side plating abreast of the shafting between frames 143 and 144; the longitudinal was buckled. This leak was stopped by means of a life preserver wedged in.

Storerooms

Compartments D-105 and D-106 had the spring bearings sprung on both port and starboard sides and were leaking badly at first, but the leaks were stopped by setting up on the glands. Compartment D-110 had slight leaks at the seams abreast the port shafts at frames 146 and 147. The plating on the port side of compartment D-111 was buckled from frames 159 to 161. The stanchion in this compartment was driven down slightly, although it was not buckled. The web plating, brackets, and longitudinal were buckled from frames 158 to 164 on the port side. The starboard side was O. K. The middle line frames 162 and 163, and the web brackets buckled on the port side. The peak tank, bulkhead 164 was buckled and leaked slightly at the top of the vertical keel. This leak was calked.

Steering Gear

In compartment D-208, frames 164 to 172, the longitudinal and side plating were buckled. The knee brackets to the main deck were buckled and the rivets sheared, particularly at frames 168, 169, 170 and 171 on the port side. The diagonal stanchion brace on the port side at frame 168 was driven through the main deck, and the stanchion at frame 170 on the port side dropped out. The galvanized rack for oil cans on the port side of this compartment was blown adrift. A number of scattered rivets in the frames and longitudinal (fourteen in all) were sheared between frames 168 and 172. The starboard side of this compartment was O. K. The peak tank on the port side, plating, frames and partial bulkheads were all slightly buckled or bent from frames 164 to 175. A number of leaky seams were found here.

One life line stanchion and all life lines on the port side aft were blown away. The flagstaff, steering room ventilator and one 50-gallon steel drum full of gasoline were blown overboard.

Damage to Gun Mount

No. 4, 5-inch, 51 caliber gun was not injured. The gun carriage was spread apart about three-quarters of an inch at the extreme end of the trunnions; this left the gun resting o nthe lower cap squares of the carriage. The upper cap was not injured, but the left one was raised and split, thereby stripping the holding down bolts which secured both squares. The roller path of the training gear was damaged to such an extent that the gun could not be trained through more than six degrees. This was caused by the gun carriage and slide being driven aft, while the inside mount remained stationary. This caused the after guide lug with its holding down bolts to be broken off. The firing circuit of the gun leading from the transfer switch to the firing key, then to the pin, then to the bolts and screws holding the firing circuit was torn loose.

The tompion was in place when the explosion occurred, which complicated any efforts to explain these damages.

Propeller Struts Broken

Both port propeller struts were broken, the lower one being broken at the outboard end and cracked on the inboard end. The upper starboard propeller strut was broken.

Both tails shafts were sprung and the port stern shaft was bent. Practically the complete girth of the ship except the keel was buckled at about frame 142. The stern was bent 1 inch to the starboard, commencing at frame 141.

The main keel was not damaged.

Every effort was made by the officers and men to bring the *Kane* from the scene of the explosion to Copenhagen in the most satisfactory condition practicable. The vessel was towed to Libau and from Libau to Copenhagen by the United States destroyer *Brooks*. There was considerable working of the stern of the *Kane* during this voyage, which was relieved to some extent, by fore and aft shoring across the buckled portion of the ship. On October 7, the *Kane* was docked at Landskrona, Sweden, and repairs immediately undertaken.

Weight Allowances

Crew and effects.—Allow about 1 ton per 10 men.

Passengers.—Allow 1 ton for every 15 persons in ordinary cases.

Passengers.—Allow 1 ton for every 20 persons in excursion crowds.

Baggage.—Allow 1 ton for every 250 persons in excursion crowds.

Baggage.—Allow 1 ton for every 10 persons in long voyages.

Fresh water.—Allow 1 ton per day for every 60 first or second class passengers.

Fresh water.—Allow 1 ton per day for every 300 third class and steerage passengers.

Salt water for sanitary purposes.—Allow from ½ to 5 tons, according to extent of sanitary accommodations.

Provisions.—Allow 1 ton per day for every 100 first and second class passengers.

Provisions.—Allow 1 ton per day for every 450 third class and steerage passengers.

Bedding, napery, cutlery, crockery, glass, silverware.—Allow 1 ton for every 30 persons on board.

Lake Plan of Vessel Salvage.—Simon Lake, inventor of the Lake type of submarine, is experimenting with a new method of raising sunken vessels by injecting into the hull by means of centrifugal pumps small blocks of balsa wood, the buoyancy of which is expected to raise the vessel.

Fig. 1.—S. S. *Robin Gray*, Express Freighter of 10,400 Tons Deadweight, Built by Skinner & Eddy Corporation, Seattle, Wash., and Fitted With General Electric 3,000-Horsepower Geared Turbines of the 2-Plane, Double Reduction Type. Speed of Vessel Loaded 11.5 Knots

The General Electric Marine Geared Turbine

BY C. H. PEABODY, DR. ENG.

The real problem of the application of the steam turbine to marine propulsion comes from the fact that the steam turbine is essentially a high speed machine while the propeller must have a good diameter and must run slowly. The General Electric Company offers a complete solution of this problem; for large ships they offer the electric drive and for small and medium sized ships they offer the double geared steam turbine. This article presents the latter.

FIG. 1 shows a recent application of the General Electric Company's turbine to the S. S. *Robin Gray* and *Robin Goodfellow*. These sister ships have 10,400 deadweight tons capacity, 3,000 horsepower and 11.5 knots speed loaded. Fig. 2 shows the engine room of these steamers.

The most characteristic illustration of the turbine and gears is given by Fig. 3, showing the upper half of the casings removed and the turbine rotor and gears in place. The turbine complete is shown by Fig. 5. These illustrations show that the turbines and gear form a completely self-contained unit that, if need be, may be manufactured, erected, adjusted and tested at the company's works, may be shipped intact and delivered in the engine room of the ship ready to connect to the steam main and the propeller shaft. A notable feature is the rigidity of the casing that needs only to be bolted down to the engine foundation as shown by Fig. 5.

The Turbine

The steam turbine is of the same type as that supplied by the General Electric Company to power and electric stations and it runs with the same regularity and efficiency. The construction of the turbine is shown by Fig. 4. There are five stages for the regular turbine used in forward gear and two stages for the backing turbine. The first stage for both forward and backing turbines has two velocity stages; all other stages are single pressure stages. The steam enters the steam chest as shown by the arrow at the right (Fig. 4) and expands in a series of nozzles and then passes the first set of blades of the wheel, is reversed by stationary guides and passes through the second set of blades. The advantage of this arrangement is that the steam is reduced in pressure and temperature before it enters the turbine casing. From the first stage the steam passes to the second set of nozzles in the first diaphragm and then through the second wheel and then in succession through the remaining stages to the exhaust, which is very liberal indeed.

Astern Turbine

The backing turbine is essentially a high pressure turbine, compact and powerful. There is always sufficient steam available when backing, so that economy is unimportant. The backing turbine when idle runs in a good vacuum with correspondingly small resistance.

The Curtis turbine expands the steam in any set of nozzles

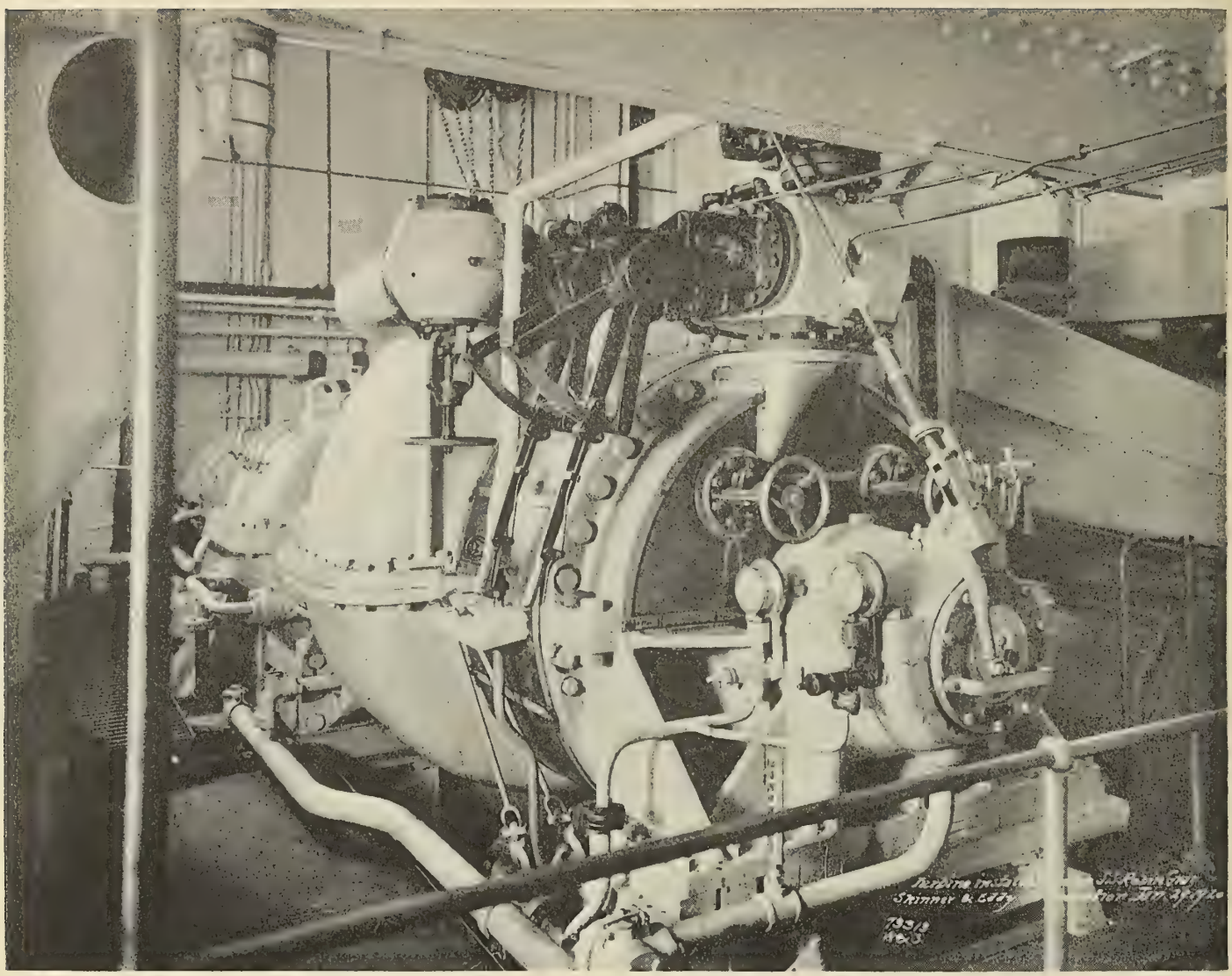


Fig. 2.—Engine Room of S. S. *Robin Gray*, Showing Operating Side of Turbine

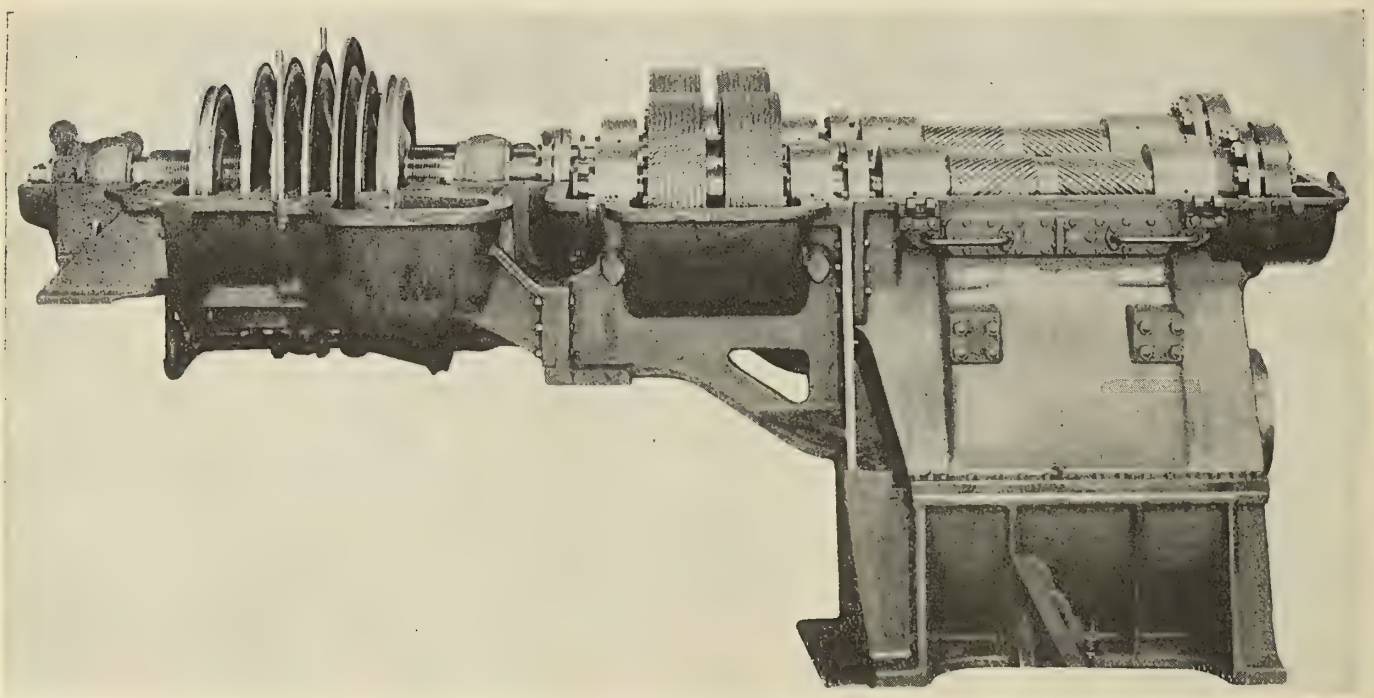


Fig. 3.—Two-Plane Type Marine Geared Turbine—Port, Looking Inboard—Upper Halves of Castings Removed, Showing Turbine Rotor and Gears in Place

THE GENERAL ELECTRIC MARINE GEARED TURBINE

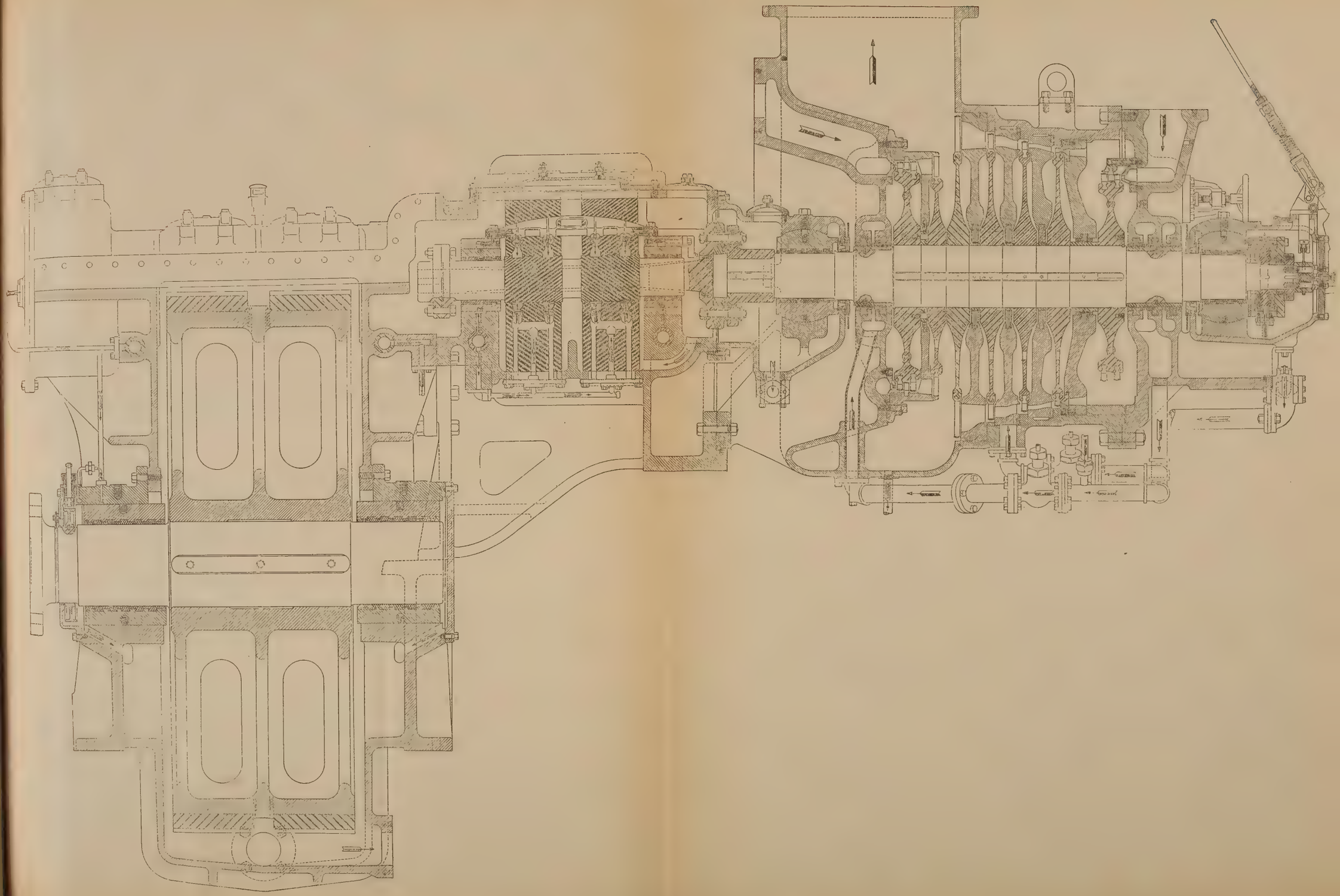


Fig. 4.—Assembly of 2-Plane, Double Reduction Type Marine Geared Turbine—Vertical Section Through Center of Turbine and Gears

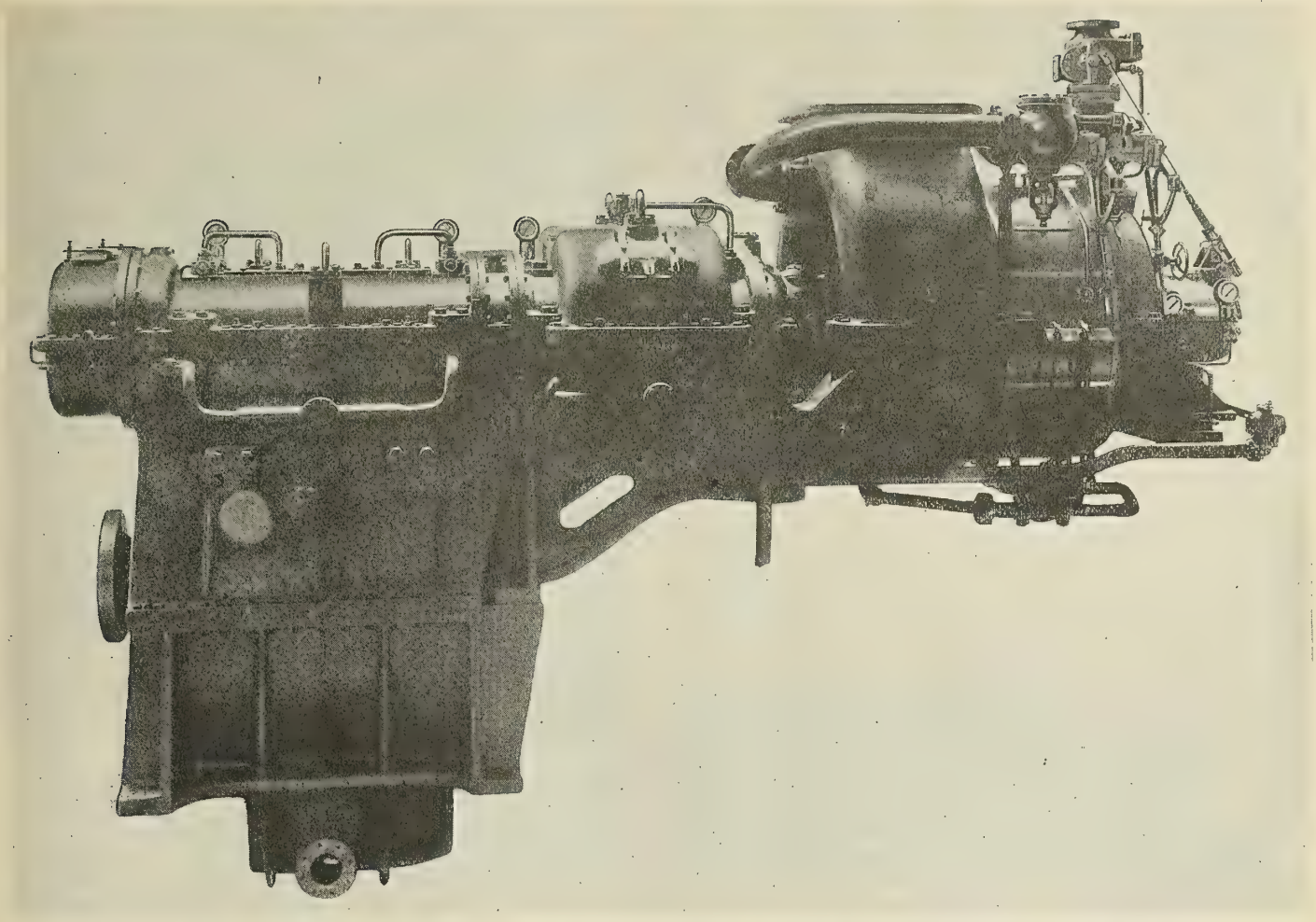


Fig. 5.—Two-Plane Type Marine Geared Turbine—Starboard, Looking Inboard—Showing Operating Side

down to the pressure of the chamber in which the corresponding wheel runs. The pressure is practically the same throughout any given chamber, and, consequently, there is no tendency for the steam to pass around the ends of the blades. A shrouding over the ends of the blades steadies them and confines the flow of steam. An important consequence is that both radial and axial clearances may be liberal and there is no risk of stripping the blades. Another consequence is that there is little, if any, end thrust on the turbine; however, an efficient step bearing is shown on the right hand of the turbine shaft to take care of any thrust that may occur and to adjust and maintain the shaft in its correct place. The blades are drop forged of manganese bronze and are especially strong at the roots, where they are machined to fit the edges of the wheels as shown by Fig. 6. The shorter blades are dovetailed to fit in a groove, but the longer ones have a dovetailed slot and straddle the edge of the wheel.

Fig. 6.—Buckets for Marine Geared Turbines

Leakage through the glands in the casing where the turbine shaft passes through is checked by labyrinth packings as shown on Fig. 4. There is another labyrinth packing between the first and second stages. The packings in diaphragms between other stages, where the fall in pressure is less, are simpler in form, but work on the same principle. The labyrinth packing at the high pressure end of the shaft is double. The leakage from the first stage of the packing is piped over to supply low pressure packing at the other end of the shaft; the outer stage is piped to a lower stage of the turbine.

Turbine Wheels and Casing

The turbine wheels are turned from solid steel forgings and pressed onto the shaft as shown by Fig. 7. This illustration shows also the bronze sleeves carrying the running rings of the labyrinth packings and the flange which delivers the power to the gearing. The casing is parted horizontally through the axis of the shaft, and the diaphragms are made in halves set in the upper and lower parts of the casing. The turbine can be opened by lifting the upper part of the casing as shown by Fig. 8, which shows one of the guide pins in place.

Steam to the turbines passes through an emergency valve with a tripping device for rapidly shutting off steam in case the speed increases dangerously or for any other reason; then the steam passes through the maneuvering valve, by which it is directed to either the forward or backing turbine. In addition there are two hand valves for controlling the pressure on the first set of

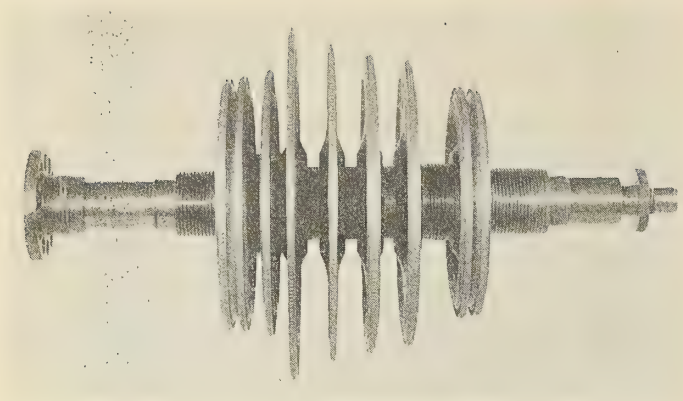


Fig. 7.—Turbine Rotor

nozzles when the ship is running slowly in stormy weather or for any other reason.

The Gearing

The outstanding feature of the power unit as shown by Fig. 5 is that the gearing is larger and heavier than the steam turbine, and yet the unit is compact and the engine room is conveniently arranged as shown by Fig. 2. The reason is that the steam turbine has come to its normal condition and is a small high speed motor, making 3,000 revolutions per minute. The propeller makes 100 revolutions per minute and has desirable diameter and pitch ratio. The two pinions, as shown by Figs. 9 and 10, are made of hollow forged high carbon heat treated steel. The two gears have cast iron hubs, but the teeth are cut in heat treated forged steel tires which are shrunk on the hubs (see Figs. 11 and 12). The teeth of both sets of gears have a helical angle of 35 degrees; the high speed set are 4 pitch and the low speed are 2½ pitch. The teeth have involute outlines, as shown by Figs. 13 and 14; all high speed gears are involute gears because they can be cut with extreme accuracy and because they engage correctly even though the distance between the axis of the gears differs from the designed distance.

Perhaps the most interesting feature of this turbine arrangement is the provision for free running of each individual element of the gear. Of course, the turbine rotor is balanced by the usual certain and precise methods used for parts having high rotative speed. In addition, the shaft bearings, as shown by Fig. 4, are carried by blocks with a spherical form, so that to some extent the shaft may find its own alinement. The turbine shaft, as shown by Fig. 9, is connected to the far end of the high speed pinion by an internal shaft of small diameter. This internal shaft is coupled to the turbine shaft by pins which give a slight freedom or play between the flanges on these shafts; consequently, the pinion is free to run in its own bearing and to seek the slight end adjustment necessary to ensure equality of bearing for the two helical sets of teeth. Since all parts are machined and fitted with the extreme precision of high grade modern machine work, a very slight degree of movement is all that is necessary for free running.

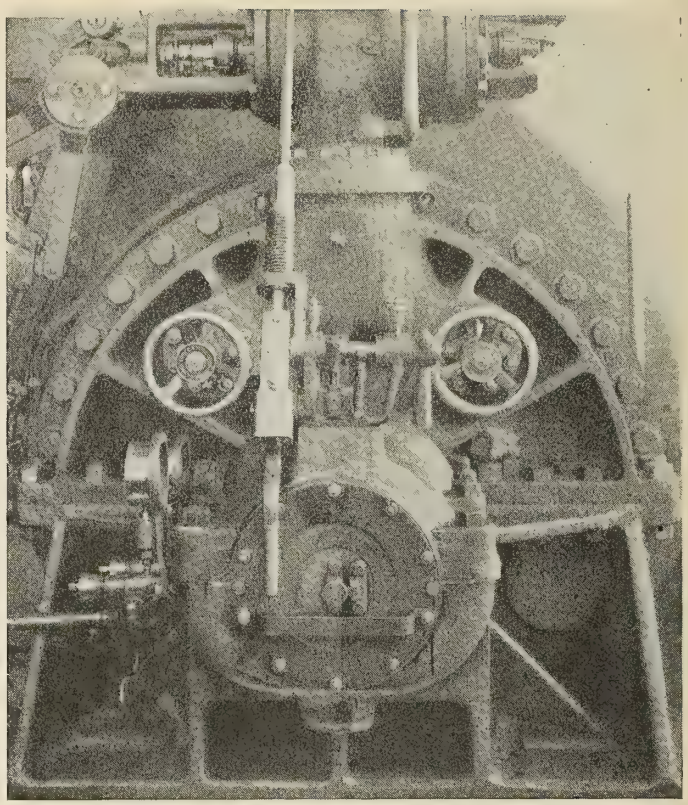


Fig. 8.—Marine Geared Turbine Forward-End View, Showing Hand Valves, Clearance Indicator and Emergency Tripping Devices

The same device is used to secure freedom between the high speed gear and the low speed pinion. The pin device is placed at the far end of this pinion for convenience in construction. It will be noticed that the holes in the flanges for both high speed and low speed couplings are bushed and that the low speed pins have sleeves. The full floating bushing around the low speed pins allows an equal distribution of load, and provides a positive method for checking the alinement during and after installation; replacement, when wear occurs, is easy and cheap.

The low speed gear is on the propeller shaft and is main-

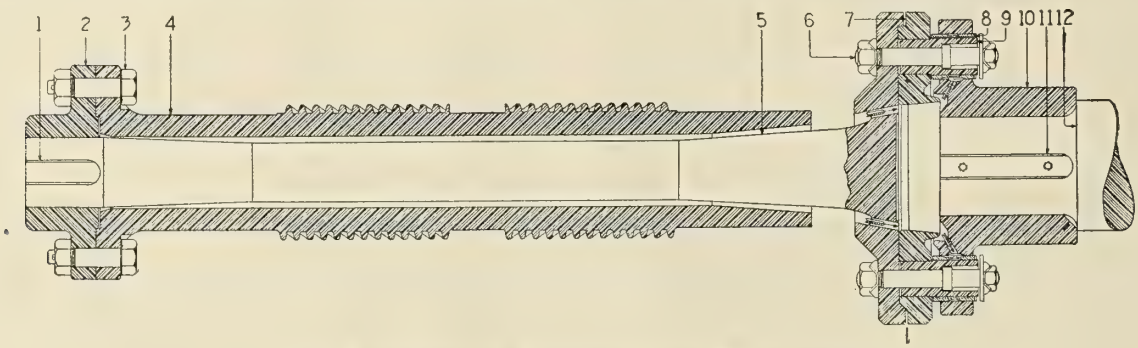


Fig. 9.—Assembly of High-Speed Pinion With Couplings

1 Key for 2 and 5
2 Flanged coupling for 5
3 Body bound coupling bolt with nut and cotter for 2 and 4
4 Hollow or quill-type pinion
5 Flexible shaft with coupling flange
6 Bolt with nuts, locking plates, and washer for 5, 7 and 10
7 Coupling flange—male half
8 Bushing
9 Coupling pin
10 Flanged coupling for 12—female half
11 Key for 10 and 12
12 Turbine shaft

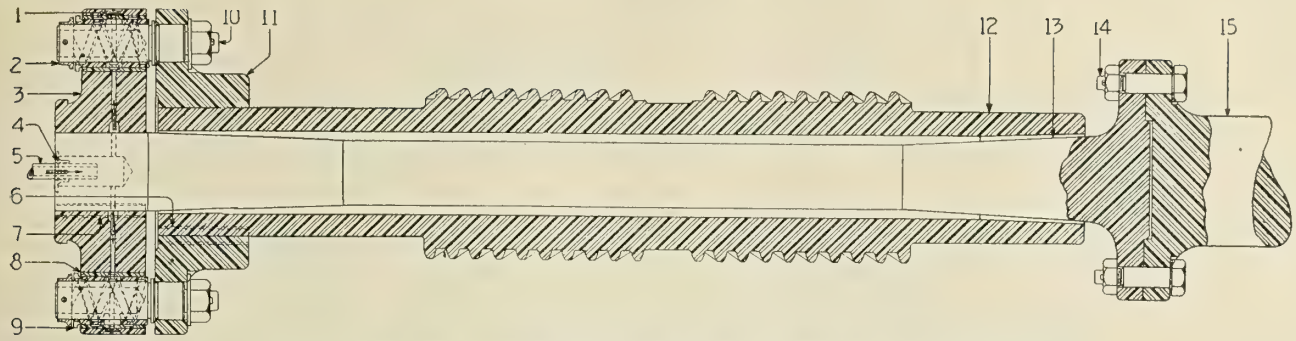


Fig. 10.—Assembly of Low Speed Pinion With Couplings

1 Locking screw
2 Retaining ring
3 Coupling half for 13
4 Bushing
5 Pipe
6 Key for 11 and 12
7 Key for 3 and 13
8 Bushing
9 Sleeve
10 Coupling pin with washer, nut, and cotters for 3 and 11
11 Coupling half for 12
12 Hollow or quill-type pinion
13 Flexible shaft with coupling flange
14 Body bound coupling bolt with nut and cotter for 13 and 15
15 High-speed gear shaft with coupling flange

tained in its position by the propeller thrust bearing, which must consequently be set and watched with care, because the freedom of the pinion, while sufficient when the gear is in adjustment, is, after all, very small in absolute movement. The upper half of the gear casings can easily be raised, exposing the gears and the bearings of their shafts. In addition there are flaps that can be raised for ready inspection.

Lubrication

The gears and all the bearings are lubricated continuously and liberally with oil that is filtered and cooled systematically, each part having its own supply under ready inspection. Any failure to maintain proper lubrication with cool, clean oil will lead immediately to deterioration and may cause extensive damage.

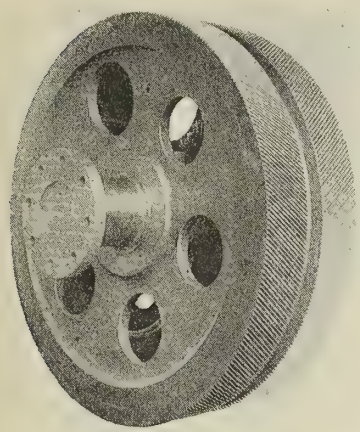


Fig. 11.—High Speed Gear

Since there is no wear on the turbine save that of the steam on the blades, and since the wear on gears and bearings is very slow, if proper provision is made to avoid excessive pressure and if proper lubrication is maintained, a geared turbine should run a long time without overhauling. If from any cause wear of gearing or bearings is appreciable, the best remedy is replacement, which can best be done at a home port.

Operation and Maintenance

It has been frequently pointed out in this magazine that the steam turbine is the builders' job. It is delivered shut up in a box with instructions to maintain certain adjustments and to see that it is supplied with clean steam and oil. These instructions are simple, but to carry them out requires intelligence and vigilance on the part of the engineers. There is probably little that the engineer can do for the steam except to see that the boilers are run under regular normal conditions and to watch the feed water for contamination with oil and salt. Any salt in the feed water indicates trouble in the condenser, either from leaky or broken tubes. So long as direct acting steam pumps and other steam auxiliaries are used there is liability that oil will get into the condenser and boilers, even though the feed water is filtered. The engineer will find that the amount of oil may be kept down by keeping the auxiliaries in good condition and watching the younger engineers and oilers; the last is the most important.

The temperatures of the oil fed in and drawn out from

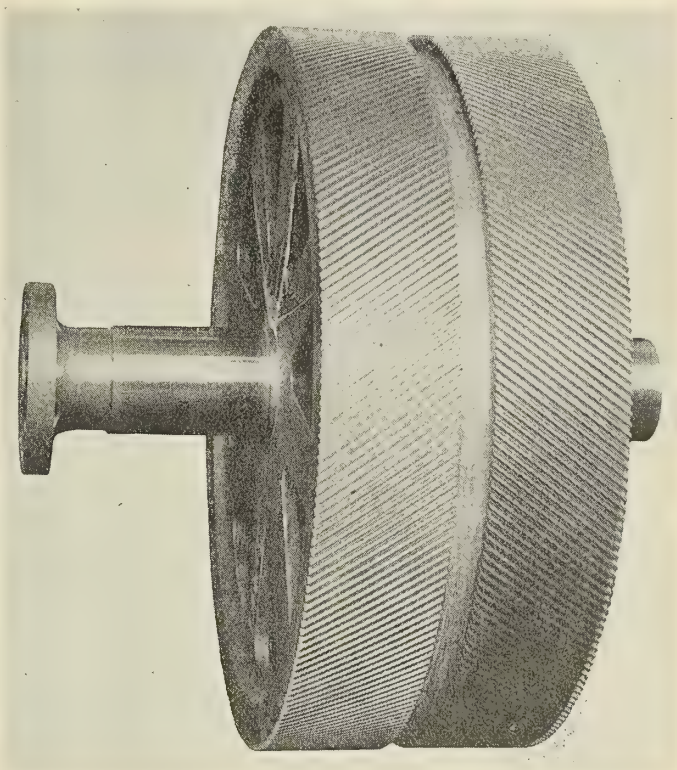


Fig. 12.—Low Speed Gear

the gearing and bearings should be watched with extreme solicitude; any sudden rise means that something is very wrong. Two things should be done at once: all the adjust-

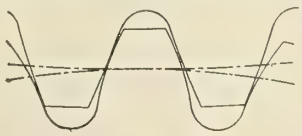


Fig. 13.—High Speed, 4-Pitch, 35-Degree Helical Angle Teeth

ments should be checked up and corrections made, if necessary, and the parts showing heating should be flooded with

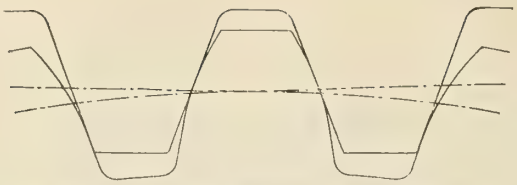


Fig. 14.—Low Speed, 2½-Pitch, 35-Degree Helical Angle Teeth

oil. The engineer should learn the simpler methods of testing oil and practice them as a regular routine, especially tests for presence of metal from the bearings. The engineer of a turbine steamer who knows his work and is on the alert should have a mind free from anxiety unless it may be for the fireroom.

Memorandum Governing Requirements for Fuel Oil Installation

Tanks

Tanks separate from hulls to be constructed of material not less than 5/16 inch in thickness.

Double riveted. Rivets spaced not more than four diameters from centerline to centerline.

Holes drilled and burrs removed after drilling.

Seams calked inside and out.

On wood vessels lead lining to be placed under tanks separate from hulls, lining to have a weight of not less than 8 pounds to the square foot.

Tanks to be properly braced and securely fastened to hull.

These tanks to be at least 18 inches from the boiler at all points, except back.

Valves to be placed on all tanks separate from hull at suction.

Tanks separate from hull to be tested to a hydrostatic pressure of 15 pounds.

Distance between tanks and back of boiler to be not less than 24 inches.

Double bottom tanks and other compartments to be tested as required by the American Bureau of Shipping.

Piping

Pipes and valves over 2 inches in diameter must be flanged to tanks.

Filling pipes must extend to bottom of tanks and must be fitted with U-bend extending upward at least 12 inches; or pipe brought to within one-half of its diameter of the bottom of tank.

Vent pipes must be the same area as filling pipes except a separate overflow is provided. If overflow is fitted with valves, check valve only allowed.

Vent pipes requiring bends must not use bends exceeding 45 degrees.

Upper ends of vent pipes to be carried above upper deck of superstructure, terminated in a U-bend properly covered with wire gauze.

Sounding pipes are not required by these rules, but if fitted must extend as close as practicable to bottom of tank.

Smothering pipes are not required, but if installed must be at least 1½ inches in diameter.

Pipes and connections between oil fuel feed pump and burners to be tested to 500 pounds on all high pressure systems.

Pipes between oil fuel feed pump and burners to be of extra heavy material.

Valves

Valves on all tanks to be accessible at all times or to have extension rods leading to deck.

Throttle valve of oil fuel feed pump to be provided with means of closing from a place outside the fireroom or pump room and not directly above the fireroom.

Valves over 2 inches in diameter to have bolted bonnets.

Tanks which are a source of supply to the pumps supplying the burners shall be fitted with an internal gate valve operated by an extension rod leading to an accessible point in an open space on deck outside the engine and fireroom casing.

Pumps

Transfer pump to be connected to oil fuel system only.

Openings

No holes to be cut in sides, bottoms or ends of tanks except for suction.

Heaters

Exhaust steam from coils used to heat fuel oil to be led to separate inspection tank, and in no case discharged into bilge.

Expansion Trunks

Expansion trunks extending above the deck must have all rivet holes drilled and be double riveted.

Fire Extinguishers, Etc.

On all vessels of over 500 tons there shall be in each fireroom a metal tank containing 50 gallons of sand and provided with scoop or shaker for fire purposes; also two approved fire extinguishers placed accessible to fireroom and ready for immediate use.

On vessels of 500 gross tons and under tank to contain 25 gallons of sand and one approved fire extinguisher.

Applications and Blue Prints

Application to be submitted to office of supervising inspector in triplicate.

Drawings or blue prints to be submitted to the office of the supervising inspector in triplicate, showing proposed installation.

Drawings or blue prints to show location, thickness and style of riveting of tanks.

In case of tanks separate from hull, fastening to hull should be shown.

Filling and vent pipes to be shown; also location of upper end of these pipes and connections at tanks.

Method of connecting all valves to tanks to be shown.

Oil fuel system proper to be shown. This includes pumps, heaters, valves and burners.

Extension rods from emergency shut-off for throttle of oil fuel feed pump and extension rods from oil suction valves to be shown.

Piping from oil fuel feed pump to burners to be shown extra heavy on all high pressure systems. (Any system using a pressure from a pump for atomizing is considered a high pressure system.)

Method of removing water from oil tanks and disposition of exhaust steam from heater coils.

Means of raising steam on boiler when it is cold, on vessels having one boiler.

Cost of Danish Shipping

According to the *Berlingske Tidende* of Copenhagen, the following table gives the cost of running a vessel of 2,400 tons deadweight at the present time and before the war.

	1914	1921
Daily expenses	$30	$139
Wages per month (not including war risk insurance on crew and officers' pensions 6 percent)	$263	$1,276
Food per man per day	15.6c	23c
Overtime on board	5c to 7c	31c to 38c
Price of coal in Great Britain per ton	$2.00 to $2.50	$12 to $14.00
Price of coal in Denmark per ton	$2.49 to $2.80	$18 to $26.50

Insurance rates have increased five to six times the amounts payable in 1914.

Diesel Engine Crankshafts

Investigation Made in Connection with Classification Rules of the American Bureau of Shipping

BY JOSEPH HECKING*

NO part of the Diesel engine is looked upon with as much suspicion as the crankshaft. The mechanism of the valves and the stresses in other parts due to heat and pressure are calculated to such a nicety that little serious trouble is experienced from this source, but crankshafts continue breaking apparently without cause. The reason for this condition is the fact that there are so many abnormal conditions and combinations of adverse circumstances in the life of a crankshaft that it is impossible to anticipate all such conditions in the calculations.

Law of Comparison

The writer recently asked a well-known engineering professor with regard to the proper method of calculating the crankshafts and received the startling answer: "The more you figure, the more you may be sure that you are wrong; the safest formula is this: $D^3/D_x^2 = d^3/d_x^3$, where D and D_x represent the diameters of the old and new cylinders respectively, and d and d_x the diameters of their crankshafts." In other words, if an engine works satisfactorily with a crankshaft of a certain size, a similar engine may have a shaft in the above proportions.

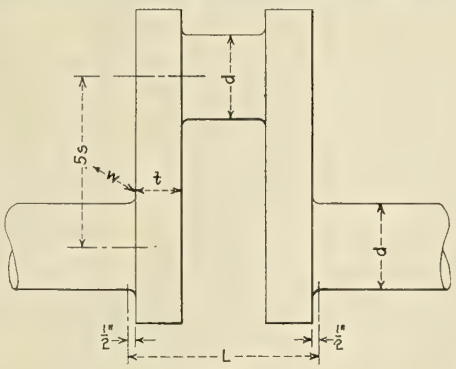


Fig. 1

Most crankshafts are designed in this manner, and even in the case of entirely new designs and where a thorough analysis has been made of all the loads and conditions involved, the engineer does not finally determine on the size of the shaft without consulting the plans of somewhat similar engines. This fact is not at all surprising, as experience only can verify our calculations and teach us the application of proper assumptions and constants. Considerable research work has been performed by engineers in the oil engine industry and many broken shafts have been replaced before we arrived at the safe sizes and safe materials for oil engine crankshafts.

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There are several fundamental requirements which apply to all shaft calculations alike, and these are: a rigid bedplate, solid foundations, sound material and good workmanship. Under these considerations the following analysis is offered to those who wish to acquire at least a general knowledge of the calculations involved and who desire a formula readily adjustable to suit varying conditions.

Terms Used

The following terms are being used in this analysis:

P = maximum initial pressure, pounds per square inch.
D = diameter of cylinder, in inches.
C = load in direction of connecting rod.
T = tangential force.
B = bending force.
M_t = twisting moment.
M_b = bending moment.
α = angle of crank and vertical centerline.
β = angle of connecting rod and vertical centerline.
δ = angle of connecting rod extension and tangential to crank circle.
EM_b = equivalent bending moment.
L = fore and aft length of crank over webs + 1 (inches).
f = allowable working stress per square inch.
a = crankshaft constants.
d = diameter of crankshaft.
t = thickness of crankweb.
w = width of crankweb.

Point of Maximum Strain

Taking at first a single cylinder engine under consideration it is essential to determine the point of maximum strain in the crankshaft. This point is given by various authorities as located between the crank angles of 25 and 35 degrees in the power stroke. A typical indicator card is shown in Fig. 2 (the pressure curve having been magnified in order to make clear the drop in pressures) and the positions of the piston and the crank for crank angles of 25, 30 and 35 degrees have been indicated to find the point of maximum strain.

In the top position the shaft is subject to bending only. The load on the piston equals $.7854D^2P$, the crankpin is assumed to be loaded in the center and the points of support one-half inch beyond the crankwebs (see Fig. 1). The bending moment is, therefore, $\frac{WL}{4} = .7854D^2P \times .25L = .196D^2PL$.

The process of the calculations to obtain the equivalent

TABLE I.

Crank = 1, stroke = 2, connecting rod = 4.5, length between bearings L = 2, S = L, bending moment = $M_b = \frac{WL}{4}$.

1	2	3	4	5	6	7	8	9	10	11	12	13	14
Angle α	Piston Press.	Piston Load	Angle β	cos. β	$C = P/\cos.\beta$	Angle δ	$T = P \times \cos.\delta$	$B = P \times \sin.\delta$	$M_t = T \times .5S$	$M_b = B \times .25L$	$\tan.\epsilon = M_t/M_b$	cos. ϵ	$EM_b = M_b/\cos.\epsilon$
Top	P	$.7854D^2P$	0	0	0	0	0	$.7854\ D^2P$	0	$.196\ D^2PL$	0	0	$.196\ D^2PL$
25°	$.947\ P$	$.744\ D^2P$	5° 23′	.996	$.746\ D^2P$	59° 37′	$.377\ D^2P$	$.643\ D^2P$	$.189\ D^2PS$	$.161\ D^2PL$	1.173	.649	$.248\ D^2PL$
30°	$.881P$	$.692\ D^2P$	6° 23′	.994	$.696\ D^2P$	53° 37′	$.413\ D^2P$	$.561\ D^2P$	$.207\ D^2PS$	$.140\ D^2PL$	1.48	.560	$.250\ D^2PL$
35°	$.753P$	$.600\ D^2P$	7° 20′	.992	$.605\ D^2P$	47° 40′	$.407\ D^2P$	$.447\ D^2P$	$.204\ D^2PS$	$.112\ D^2PL$	1.822	.481	$.233\ D^2PL$

TABLE II

Conn. Rod Cranks	Piston Load D^2P	Angle β	cos. β	$\frac{C}{D^2P}$	Angle δ	cos. δ	sin. δ	T in D^2P	B in D^2P	M_t in D^2PS	M_b in D^2PL	tan. ϵ M_t/M_b	cos. ϵ	$\frac{EM_b}{D^2PL}$
4	.692	7° 11′	.992	.698	52° 49′	.604	.797	.421	.556	.211	.139	1.518	.55	.253
4½	.692	6° 23′	.994	.696	53° 37′	.593	.805	.413	.56	.207	.140	1.479	.56	.250
5	.692	5° 44′	.995	.695	54° 16′	.584	.812	.406	.564	.203	.141	1.44	.57	.247

bending moments for the various crank positions is shown in Table I. Column 2 gives the piston pressure in relation to the maximum pressure; column 3, the corresponding load on the piston; column 4, the angle between connecting rod and vertical centerline of the engine, and column 5, the cosine of this angle; column 6, the load in the direction of the connecting rod (3 divided by 5); column 7 gives angle δ, dividing load C into T (column 8) and B (column 9) by multiplying C in column 6 by the cosine and the sine respectively of angle δ. Assuming now the crank length as unity = 1, the stroke equals 2, and for comparative purposes L may be taken as = 2. (The effect of the ratios of stroke to span between bearings will be investigated later.) The twisting moment in

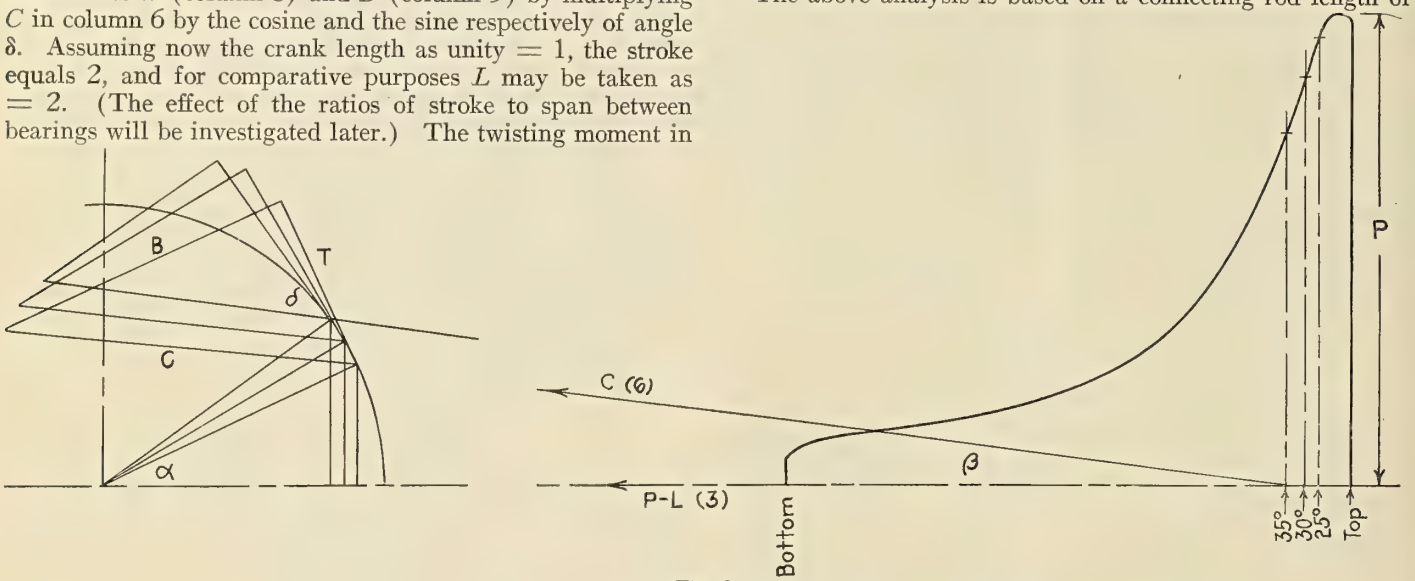


Fig. 2

column 10 is therefore T in column 8 multiplied by the crank length or by .5S and the bending moment in column 11 is B in column 9 multiplied by $L/4$ (see $\frac{WL}{4}$ above). Columns 12, 13 and 14 require explaining in detail.

Derivation of Equivalent Bending Moment

The generally accepted formula for finding the *equivalent* bending moment where the bending moment and twisting moment are known is $EM_b = \sqrt{M_b^2 + M_t^2}$. This value is easily recognized from the Pythagorean Theorem as the hypothenuse of a rectangular triangle, the two sides being M_b and M_t (see Fig. 3). Tan $\epsilon = \frac{M_t}{M_b}$; for the 25-degree position $\frac{.189D^2PS}{.161D^2PL} = 1.173\ \frac{S}{L}$, and having in this case assumed $S = L$, tan $\epsilon = 1.173$. The corresponding cosine ϵ is .649 and the hypothenuse, or EM_b, equals the bending moment M_b divided by cosine $\epsilon = \frac{.161D^2PL}{.649} = .248D^2PL$.

Influence of Connecting Rod Length

The indicator card used in Fig. 2 is taken from a large six cylinder four cycle engine of modern design and shows a fairly even expansion curve, and inasmuch as no two indicator cards are alike, quite different values may be obtained by analyzing other cards, but the result as to the location of the point of maximum strain in the crankshaft varies very little. The assumption that this point is located at the 30-degree angle position of the crankweb in the power stroke is sufficiently correct for all practical purposes.

The above analysis is based on a connecting rod length of 4½ cranks, which is the average of present-day practice; rods of a length of 4 or 5 cranks will affect the proportions of M_t to M_b only to a minor degree, as shown in Table II.

Effect of Stroke to Length Ratio

In the foregoing analysis it has been assumed that the stroke S = distance between bearings L. A tabulation of a number of designs shows that the S/L ratio is subject to a variation from .75 to 1.35. It is evident therefore that any formula based on a fixed S/L ratio for all engines does not fairly cover the conditions, as the following indicates.

Referring to Table I, the ratio $S/L = 1$ for the 30-degree angle position gives the M_t/M_b ratio of 1.48. For $S/L = .7$, L is increased in the ratio of 1/.7 or 1.43, and the M_t/M_b ratio for a constant M_t is $\frac{.207D^2PS}{.140D^2PL \times 1.43} = 1.035 =$ tan. ϵ. For $S/L = 1.4$, L is decreased in the ratio of 1/1.4 or .715 and $\frac{.207D^2PS}{.140D^2PL \times .715} = 2.07 =$ tan. ϵ. The tangent for any S/L ratio may be more readily obtained by multiplying the tangent for $S/L = 1$ by the ratio in consideration, as $1.48 \times .7 = 1.035$.

These three conditions have been shown graphically in Fig. 4, indicating clearly that with a constant M_t and a variable M_b the effect of M_t on EM_b is greater with a decreasing

M_b and is smaller with an increasing M_b. The increase in EM_b from $S/L = 1$ to $S/L = .7$ equals 15.7 percent and the decrease from $S/L = 1$ to $S/L = 1.4$ equals 7.3 percent. The reduction of the stresses in the shaft induces the designer to reduce the distance between bearings to a minimum.

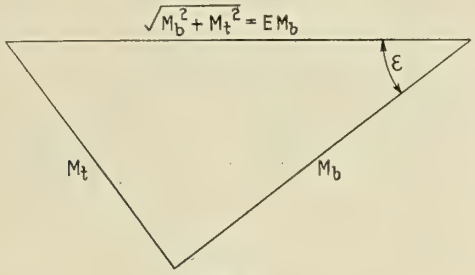


Fig. 3

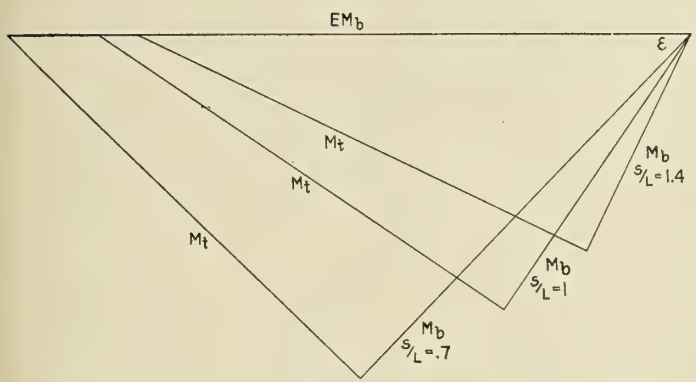


Fig. 4

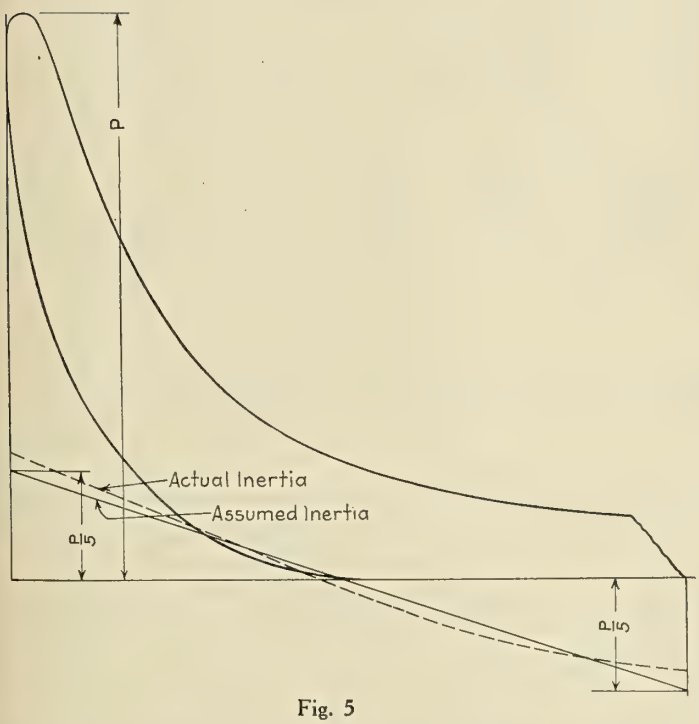
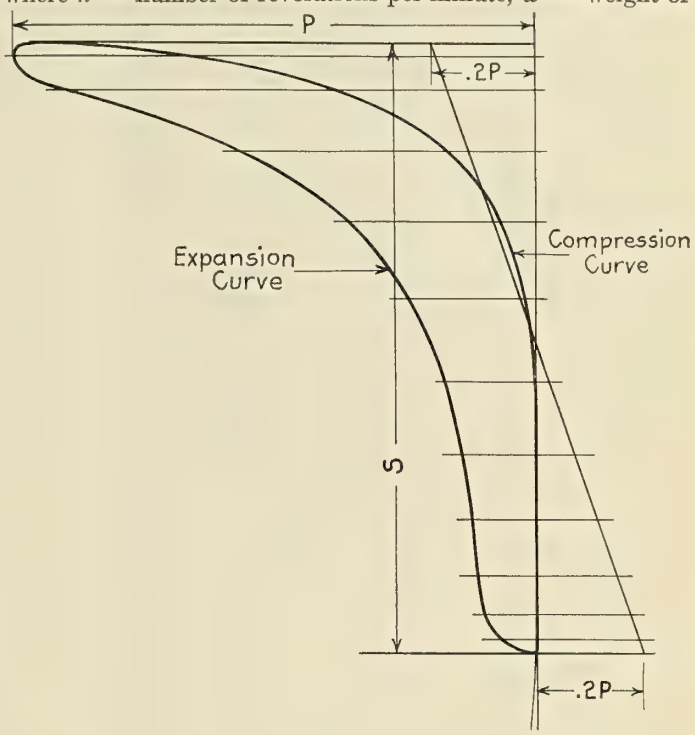


Fig. 5

The above investigation also emphasizes the necessity of taking the S/L ratios in consideration in formulating a rule for general application.

Inertia

A more serious problem for a general formula offers apparently the determination of average acceleration forces. The formula for the acceleration force at the upper dead center is $p_a = \left(\frac{n}{30}\right)^2 \times wr\left(1 + \frac{1}{4.5}\right)$, and for the lower dead center $p_a = \left(\frac{n}{30}\right)^2 \times wr\left(1 - \frac{1}{4.5}\right)$, where n = number of revolutions per minute, w = weight of reciprocating parts per square inch of piston area, r = length of crank in feet, $\frac{1}{4.5}$ the crank to connecting rod ratio, and p_a pressure per square inch.



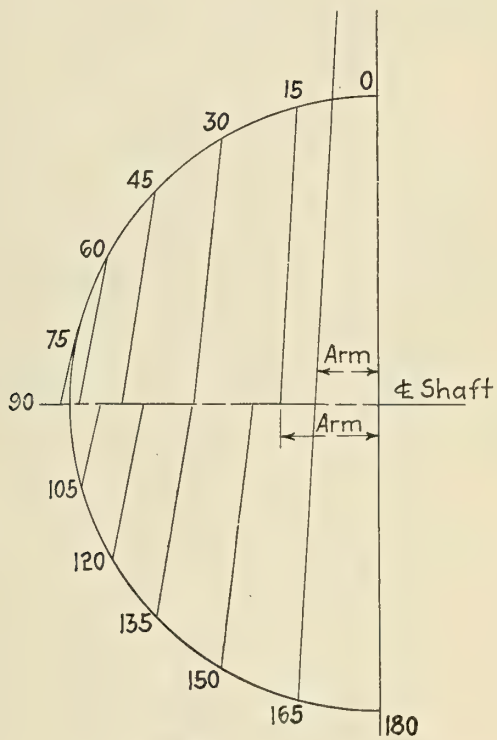


Fig. 6

The characteristic curve of acceleration forces is indicated in Fig. 5 in dotted line. The principal determining features are the velocity and the weight of the reciprocating parts. The speed of an engine and also the weights depend to a large extent on its size. Only large oil engines are built of the crosshead type, and while the weight of the reciprocating

TABLE III.

Crank Angle	Piston Press % of P	Piston Load D^2P	Arm in % of S	Mt in D^2PS	
0	.78	.612	—	—	
15	.810	.636	.153	.097	
30	.733	.576	.294	.169	
45	.440	.346	.408	.141	
60	.290	.228	.481	.109	
75	.224	.176	.510	.090	
90	.2	.157	.500	.079	
105	.213	.167	.456	.076	
120	.24	.188	.387	.073	
135	.263	.207	.298	.062	
150	.267	.21	.200	.042	
165	.26	.204	.102	.021	
180	.2	.157	—	—	Power Stroke
195	—.193	—.152	.102	—.015	
210	—.173	—.136	.200	—.027	
225	—.15	—.118	.298	—.035	
240	—.113	—.089	.387	—.034	
255	—.07	—.055	.456	—.025	
270	—.027	—.021	.500	—.011	
285	.03	.024	.510	.012	
300	.08	.063	.481	.030	
315	.127	.100	.408	.041	
330	.17	.134	.294	.039	
345	.193	.152	.153	.023	Exhaust Stroke
0	—.2	—.157	—	—	
15	—.193	—.152	.153	—.023	
30	—.17	—.134	.294	—.039	
45	—.127	—.100	.408	—.041	
60	—.08	—.063	.481	—.030	
75	—.03	—.024	.510	—.012	
90	.027	.021	.500	.011	
105	.07	.055	.456	.025	
120	.113	.089	.387	.034	
135	.15	.118	.298	.035	
150	.173	.136	.200	.027	
165	.193	.152	.102	.015	
180	.2	.157	—	—	Suction Stroke
195	—.193	—.152	.102	—.015	
210	—.173	—.136	.200	—.027	
225	—.15	—.118	.298	—.035	
240	—.113	—.089	.387	—.034	
255	—.07	—.055	.456	—.025	
270	—.03	—.024	.500	—.011	
285	+.03	+.024	.510	+.012	
300	+.013	+.010	.481	+.005	
315	—.04	—.031	.408	—.013	
330	—.227	—.179	.294	—.053	
345	—.50	—.393	.153	—.060	Compression Stroke

parts is large, the speed is generally low; the designer takes care that the weights of fast-running, small trunk-type engines are kept down. From a comparison of a number of engines of various types it has been found that the average acceleration pressure is equal to 20 percent to 25 percent of the maximum piston pressure. A maximum acceleration force of 20 percent of the maximum piston pressure is probably an assumption on the safe side, bearing in mind that this is not a question of dissipation of power, but of relocation. The power absorbed in the first half of each stroke is returned during the second half, therefore not changing the total turning effort. The acceleration used in this analysis is shown in full in Fig. 5.

Turning Effort for Each 15 Degrees of Stroke

In Table III the turning efforts have been calculated for every 15 degrees of a complete cycle of a four cycle engine with due consideration of the inertia forces. It should be noted that the inertia is negative for the first half of *each* stroke and positive for the second half. For the exhaust and suction strokes inertia only need be considered; in the case of two cycle engines these two strokes are omitted.

Special attention is directed to the peculiar condition in the compression stroke (Fig. 6), where for the 285- and 300-degree positions the positive inertia pressure exceeds the negative compression pressure, resulting in a small positive turning effort.

While in Tables I and II the turning efforts have been determined by the triangle of forces as functions of angle δ, the graphical method has been used in Table III, where the M_t for any crank angle equals the load on the piston multiplied by the corresponding distance of the intersection of the connecting rod with the horizontal centerline of the shaft from the center of the shaft marked "arm" in Fig. 6.

Another modification is the omission of the resultant pressure due to angle β. Comparison of columns 3, 5 and 6 of Table I will show that the increase in pressure due to cosine β is rather trifling and may as a matter of convenience be omitted for a general analysis.

Table III forms the basis of calculating the size of the crankshaft for engines with any number of cylinders. Having found that the maximum stress for a single crank occurs at the 30-degree angle position, the stress in the shaft aft of the after crank of multi-cylinder engines is due to the bending and torque of the after cylinder plus the torque produced by the preceding cylinders. The piston load of one cylinder at the 30-degree position according to Table III is $.576D^2P$, of which the bending force M_b equals sin $\delta = .805 \times .576D^2P = .464D^2P$ and the bending moment $.464D^2P \times .25L = .116D^2PL$; the torque has been determined graphically as $.169D^2PS$. The bending moment remains constant for any combination of cylinders.

The equivalent bending moment is derived by the method described in connection with Fig. 3 and the effect of the S/L ratio according to the explanation in connection with Fig. 4.

Total Twisting and Bending Moments of Various Engines

The sum of the twisting moments for the customary cylinder arrangements will equal crank angles, taken from Table III, are given in the first column of Table IV. In order

TABLE IV.—D^2PS

	Number of Cyl's	Cranks Apart	1	2	3	4	5	6	7	8 Average	9 Used
Four Cycle	1		.169	.152	.140	.137	.132	.156	.162	.150	.160
	2	360°	.130	.110	.113	.110	.105	.107	.119	.113	.160
	3	240°	.185	.171	.174	.172	.165	.187	.195	.178	.180
	4	180°	.076	.054	.041	.038	.037	.051	.064	.052	.160
	6	120°	.177	.172	.159	.162	.160	.178	.174	.169	.180
	8	90°	.218	.168	.167	.175	.174	.190	.197	.184	.190
	12	60°	.199	.197	.151	.169	.180	.189	.182	.183	.200
Two Cycle	1		.169	.152	.140	.137	.132	.156	.162	.150	.160
	2	180°	.142	.124	.111	.108	.105	.129	.135	.122	.160
	3	120°	.200	.195	.152	.154	.166	.170	.179	.174	.180
	4	90°	.220	.171	.168	.175	.176	.199	.200	.187	.190
	6	60°	.199	.198	.151	.169	.180	.189	.182	.181	.200
	8	45°	.246	.207	.179	.187	.192	.223	.212	.207	.225
	Mb	D^2PL	.116	.104	.096	.094	.090	.106	.111	.1025	.105

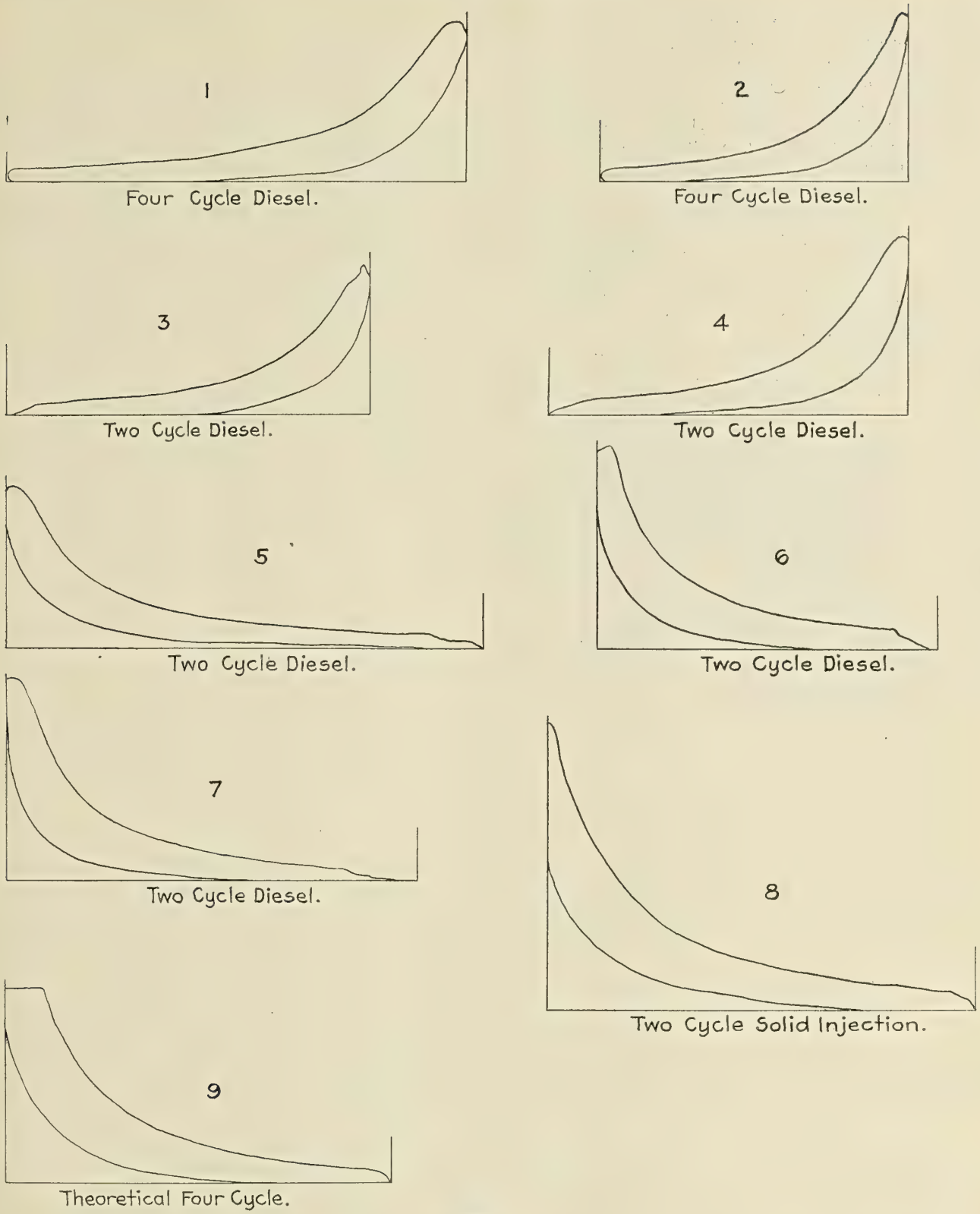


Fig. 7

to arrive at the turning and bending moments which may fairly and safely represent engines of various well-established designs (see Fig. 7), the indicator cards of six other engines have been analyzed in the same manner as the card shown in Fig. 6, and the turning and bending moments are also given in Table IV. The number at the head of each column corresponds with the number of the indicator card.

As a matter of general information and comparison, the theoretical indicator card No. 9 and a card of a solid injection engine No. 8 have been shown. Owing to the possibility of extending the time of the fuel admission in solid injection engines so that their cards appear more like the straight Diesel card (Vickers engine), the formula for Diesel engine crankshafts should also cover solid injection engines. While all cards represent normal working condition, it is possible that some are slightly overloaded and some under loaded.

No conclusions should be drawn from the cards as to the relative efficiency of the engines, as any engine may be made to produce a fuller card by increasing the fuel supply. All cards have been analyzed for 4- and 2-cycle. The average turning moments and bending moments are given in column 8.

The turning moments for single and multi-cylinder en-

gines, column 9, and the bending moment applying to all engines in the last line of column 9, which have been decided upon as representing the maximum load acting on the crankshaft, require some explanation. A two-cylinder engine (four- or two-cycle) running with one cylinder damaged and cut out would in effect be a single-cylinder engine and require a shaft equal to this condition. The turning efforts of a four-cylinder four-cycle engine are affected to a minor degree by the elimination of one cylinder; while the probability of running a four-cylinder engine on one cylinder is rather remote, prudence would advise to take care of such a condition by making the shaft equal to this condition. For the same reason the shaft of a six-cylinder four-cycle engine should not be smaller in diameter than the shaft for a three-cylinder four-cycle engine, although the normal turning efforts would permit it.

A closer examination of the turning efforts of 8- and 12-cylinder four-cycle engines reveals the fact that the peak of the turning effort curve lies forward of the 30-degree crank position (see also "The Diesel Engine," by Herbert Haas). The previous assumption that the point of maximum strain in the crankshaft is at the 30-degree crank position, requires therefore a modification. The bending moment increases from the 30 degree to the top dead center position (see Table 1). In order to maintain a constant bending moment M_b a corresponding increase has been made in the variable turning moment M_t, producing the same result as an increased M_b.

The above explanations apply also to two-cycle engines, where the turning efforts in column 9 of Table IV, have been perceptibly increased over the average values in column 8.

Working Formula

The section modulus of a circular shaft is $.098d^3$ *or* $\frac{d^3}{10.2}$.

If "f" represents the allowable fibre stress,

$$\frac{d^3 f}{10.2} = EM_b \text{ or } d = \sqrt[3]{\frac{10.2 \times EM_b}{f}}$$

EM_b consists of the numerical value "v" (see Table I), and the constant D^2PL; the derivation of the value "v" is shown in Table V. By extracting the cube root of the product $10.2v$, this value may be placed in front of the root sign as a constant "a," so that the formula takes the form of

$$d = a\sqrt[3]{\frac{D^2PL}{f}}$$

The value of "a" for the various turning moments and the constant bending moment of Table IV are determined as shown in Table V.

Example

As an illustration of the operation of the above formula, the curves for single and multi-cylinder engines with cylinders 20 inches diameter, 30 inches stroke, and a maximum working pressure of 500 pounds per square inch, are shown in Fig. 8. There are two curves, one for $S/L = .7$ and one for $S/L = 1.3$. The allowable working stress of the material has been taken as 7,500 pounds, representing material of an ultimate tensile strength of 60,000 pounds and a factor of safety 8. The constant for any number of cylinders is

$\sqrt[3]{\frac{D^2PL}{f}}$, which for the above cylinders and for $S/L = .7$ equals 10.47, and for $S/L = 1.3$ equals 8.49. These values multiplied by the value of "a" (Table V) corresponding to the number of cylinders under consideration give the diameter of the shaft.

TABLE V.

Number of cylinders	S/L	tan. ϵ	cos. ϵ	$M_b/\cos\epsilon = v\,D^2PL$	$\sqrt[3]{10.2\,v} = a$
1-2-4 cylinders, 4 cycle 1-2 cylinders, 2 cycle $M_t = .160\,D^2PS$. For $S/L = 1$ $\tan.\epsilon = \frac{.160\,D^2PS}{.105\,D^2PL} = 1.523$	.7	1.065	.685	$.153\,D^2PL$	1.16
	1.0	1.523	.549	$.191\,D^2PL$	1.25
	1.3	1.980	.451	$.233\,D^2PL$	1.34
3-6 cylinders, 4 cycle 3 cylinders, 2 cycle $M_t = .180\,D^2PS$. For $S/L = 1$ $\tan.\epsilon = \frac{.180\,D^2PS}{.105\,D^2PL} = 1.715$	.7	1.20	.640	$.164\,D^2PL$	1.19
	1.0	1.715	.504	$.208\,D^2PL$	1.28
	1.3	2.28	.409	$.257\,D^2PL$	1.38
8 cylinders, 4 cycle 4 cylinders, 2 cycle $M_t = .190\,D^2PS$. For $S/L = 1$ $\tan.\epsilon = \frac{.190\,D^2PS}{.105\,D^2PL} = 1.81$	.7	1.267	.619	$.170\,D^2PL$	1.20
	1.0	1.81	.484	$.217\,D^2PL$	1.30
	1.3	2.355	.391	$.269\,D^2PL$	1.40
12 cylinders, 4 cycle 6 cylinders, 2 cycle $M_t = .200\,D^2PS$. For $S/L = 1$ $\tan.\epsilon = \frac{.200\,D^2PS}{.105\,D^2PL} = 1.905$	.7	1.335	.599	$.176\,D^2PL$	1.22
	1.0	1.905	.465	$.226\,D^2PL$	1.32
	1.3	2.475	.375	$.280\,D^2PL$	1.42
8 cylinders, 2 cycle $M_t = .225\,D^2PS$. For $S/L = 1$ $\tan.\epsilon = \frac{.225\,D^2PS}{.105\,D^2PL} = 2.142$	.7	1.498	.553	$.190\,D^2PL$	1.25
	1.0	2.142	.423	$.248\,D^2PL$	1.36
	1.3	2.783	.338	$.311\,D^2PL$	1.47

Dimensions of Crankwebs

The determination of the dimensions of the crankwebs should be carefully considered in the design of each engine. The temptation to reduce their thickness in order to shorten the length of the engine is rather alluring but may lead to disaster. Experience has shown that by far the greater number of crankshafts break through the web on the line m-n, indicated in Fig. 9. Especially in the top dead center position, the loads and stresses are somewhat indeterminable, considering the possibility of uneven bearing levels, deflections due to the loads on the adjoining cranks and temporary excessive pressures, or a combination of the above. The tendency of design should therefore be in the direction of "safety first."

A satisfactory approximation may be obtained by the following method, basing the strength of the web on the strength of the crankpin. The shaft is considered supported at the center of each bearing (Fig. 9). Allowing again a 20 percent reduction in the maximum pressure for inertia, the load in the top dead center position is $.8 \times .7854D^2P = .628D^2P$. The maximum bending moment for the crankpin is therefore $.628D^2P \times L/4 = .157D^2PL$. The section modulus of the shaft is $.098d^3$, and $.157D^2PL = .098d^3f$, or $1.6D^2PL = d^3f$. The reaction at each bearing is $.314\ D^2P$, the moment from the centerline of the bearing to the center of the web is about $.25L$ and the bending moment $.314D^2P \times .25L = .08D^2PL$. The section modulus of the web is $\frac{t^2w}{6}$ and $.08D^2PL = \frac{t^2w}{6} f$, or $.48D^2PL = t^2wf$. The relative dimensions of crankpin and

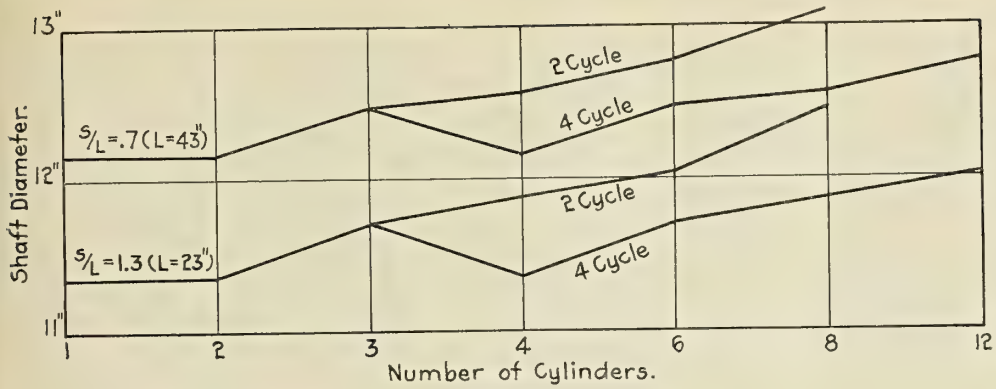


Fig. 8

web are therefore $\frac{1.6D^2PL}{d^3f} = \frac{.48D^2PL}{t^2wf}$ or $.3d^3 = t^2w$.

This proportion is based on bending forces only. The magnitude of the turning forces depends on the number of the cylinders. It would lead too far to recite here the assumptions of how this turning effort may be transmitted from the forward to the after web. It is evident that the web, having the greater moment, is subject to a more severe strain than the crankpin, which is partly protected from deflection by the surrounding connecting rod box. The above ratio of crankpin to crankweb is therefore increased to $.4d^3 = t^2w$, in accordance with good practice.

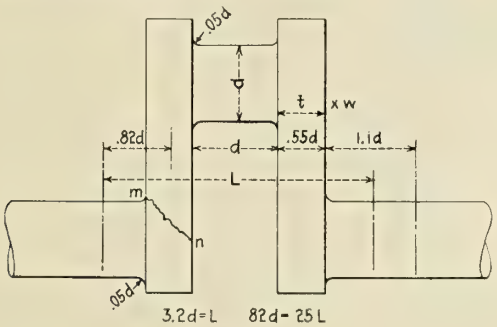


Fig. 9

For the point of maximum torque the section modulus of the shaft $= .196d^3$ should equal the section modulus of the web $= \frac{w^2t}{6}$ or $1.18d^3 = w^2t$. The ratio $d^3 = w^2t$ has been found adequate.

The crank webs of built-up crankshafts are made to the proportions inherited from the reciprocating engines, that is, the thickness of the webs $= .66d$ and the width from 1.9 to 2 times the diameter of the hole in the webs.

Shaft Material

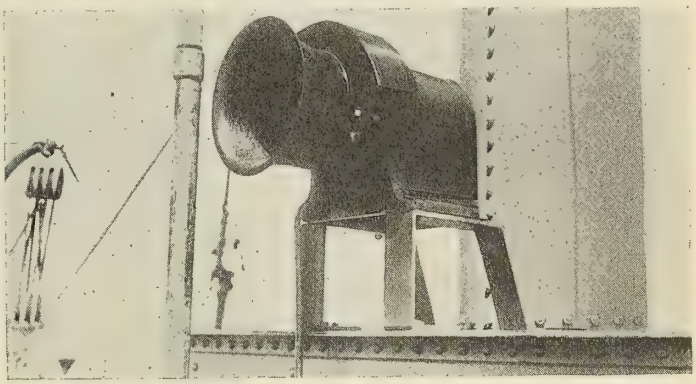
Two grades of steel are used for marine engine crankshafts, the ordinary marine steel of 60,000 pounds ultimate tensile strength, 50 percent yield point and 26 percent elongation and steel of 70,000 pounds ultimate tensile strength, 50 percent yield point and 22 percent elongation. The latter material is the more widely used. The working stress for the first is 7,500 pounds and the latter 8,000.

Electric Siren for Motorships

THE problem of providing motor driven vessels with economical and practical sound signalling devices was solved by a Seattle shipbuilding concern when it equipped the motorship *Benowa* with an electric siren. The first installation was made several months ago, and it has been so successful that since then many other motorships have likewise been equipped with them.

The siren used on the *Benowa* is a single head size siren known as type "B," manufactured by the Federal Electric Company, Chicago. It is claimed that it can be heard for more than a mile and a half and that the double head size sirens manufactured by the same concern can be heard for more than three miles.

The advantages of the electric siren over an air compressor is that the siren may be installed at one-fifth the cost of an air-sounding device and that its maintenance cost is at least one-tenth. When an air compressor device is used it is necessary to keep the motor running almost constantly to maintain sufficient air pressure, whereas in the case of a siren the motor is used only when the siren is used.



Federal Electric Single Head Siren Mounted on Motorship *Benowa*

The siren can be set in motion from various parts of the ship by merely pressing a button, when it gives a peculiar, penetrating sound, universally known to seamen as a warning signal. Hundreds of electric sirens are used by the United States Government on submarines and the like.

It is necessary to oil the siren only two or three times a year. The cost of operation for actual current consumed is only about two or three dollars a year. Every part of the siren is enclosed. The rotors are made of aluminum and cast in one piece. The horn is of cast iron. The motor drives the rotor and its revolution at a high rate of speed draws air into the large bell-shaped openings or horns at either end of the siren and forces it out through ports in the stationary housing. The alternate opening and closing of these ports by the turning of the rotor produces the characteristic sound of the siren, and the rising and falling sound, which makes it so distinctive and effective, is the result of change of speed of the motor.

PROSPERITY OF ITALIAN SHIPYARDS.—Italian shipyards, it is stated, are enjoying quite a run of prosperity. There is actually a larger tonnage under way in these yards than in any other European country except England. Italian shipyards have at present 57 steel steamers of 413,727 tons deadweight in construction of which 24 are being completed afloat, and 33 are still on the way. It is also stated that orders have been booked for an additional 39 steamers of 316,310 tons deadweight. Four wooden steamers of 5,075 tons deadweight are also building.

NEW SHIPYARDS FOR THE ARGENTINE.—An Argentine company is being formed at Buenos Ayres, with a capital of 50,000,000 pesos, with the object of establishing shipbuilding yards at the port of Carmen de Patagonia, and constructing vessels for trading with Europe.

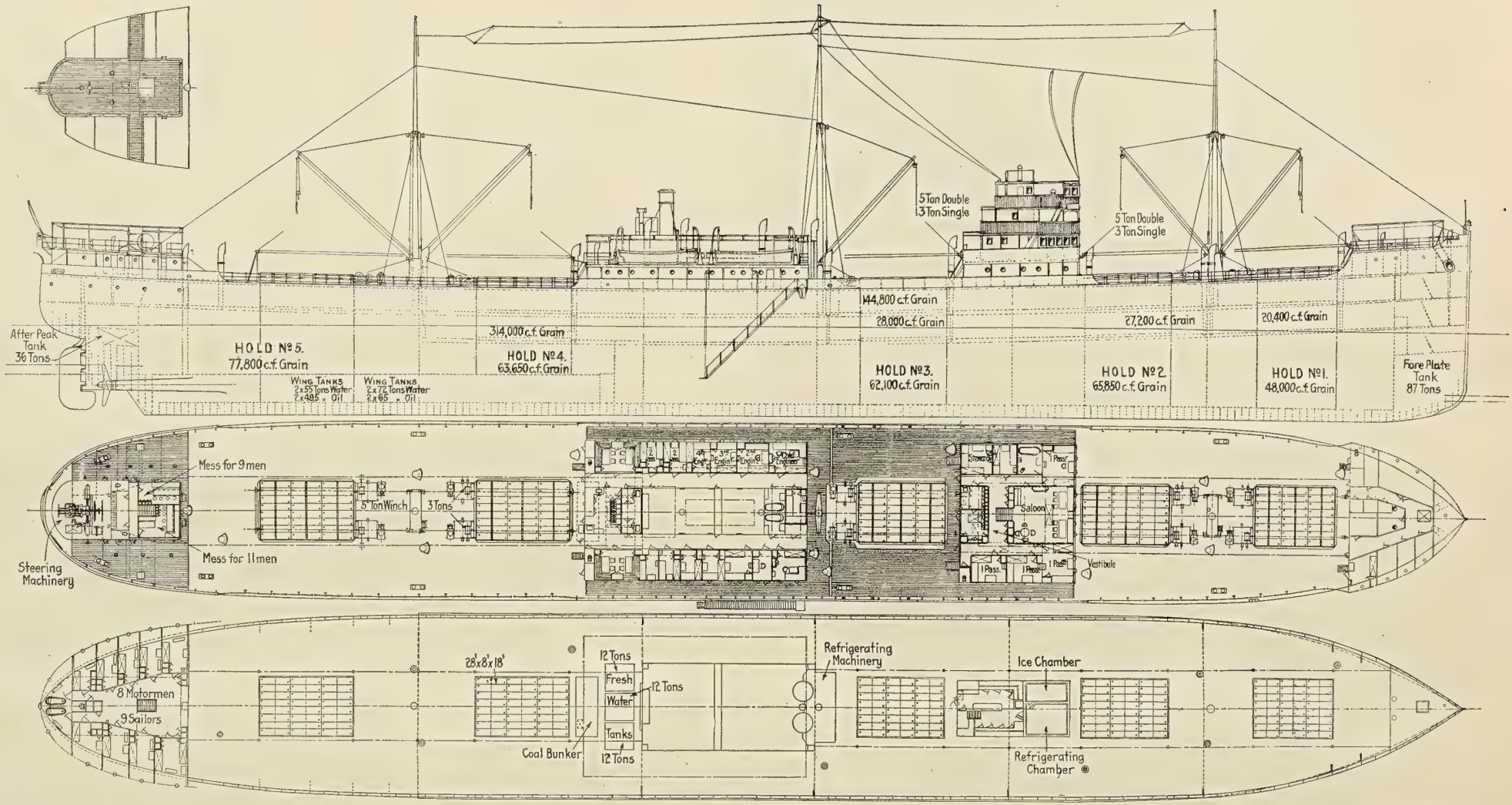


Fig. 1.—General Arrangement Plans of Motorship for the Swedish East Asiatic Company: Length Between Perpendiculars, 425 Feet; Beam, 56 Feet; Depth, 38 Feet; Draft, 27 Feet 6 Inches; Deadweight Tonnage, 10,400; Indicated Horsepower, 4,000

Fig. 2.—The New 12½-Knot, 14,000-Ton Motorship *Glenapp*, Built by Harland & Wolff

Motorship Building in Europe

BY OUR SPECIAL LONDON CORRESPONDENT

The vitality of the motorship building industry in Europe and the interest which it is arousing among engineers and shipbuilders is well indicated by the large number of technical papers which are now being read before many of the leading British engineering and shipbuilding societies. Still more important perhaps is the energetic discussion which these papers invariably arouse, and the attendance of some of the best known experts on internal combustion engines at the meetings shows clearly the enthusiasm which centers round this, the latest development in shipbuilding.

ONE of the most valuable lectures that has been delivered is that of Professor (late Commander R. N.) Hawkes before the North East Coast Institution of Engineers and Shipbuilders on Fuel Injection in Diesel Engines. Professor Hawkes was during the war in charge of the Admiralty experimental stations where very careful investigations were made into the problem of adopting oil engines for war vessels, including submarines and larger ships. In his paper a full account is given of the results achieved. He dealt more particularly with fuel injection and provided a large amount of important data on the vexed question of the relative advantages of solid and air injection.

There is no problem which in Great Britain is attracting more attention than this, as there are two schools of thought. On the one side it is held that air injection must ultimately be replaced by the employment of mechanical pumps for injecting the fuel into the cylinders; on the other hand, many engineers still believe that air injection will remain the most popular system on account of the fact that air compressors have now reached a remarkable degree of reliability and also because solid injection does not allow of the employment of the lower grades of fuel which are now becoming common.

There is no question whatever of the success of solid injection, which, as is well known, is now adopted by Vickers in all their mercantile engines and by Doxfords in their remarkable new opposed piston type. However, proofs are not yet available that this success will be maintained when such poor fuel as Mexican oil is used, and those who adhere to air injection claim that within the next few years all motorships will have to burn the crudest oil, as there will be a shortage of the lighter qualities. This is the crux of the question, and although Doxfords claim that in their new engine they are able to utilize Mexican fuel oil such as is now burned under boilers, it will be impossible to attach much importance to this claim until the first ships equipped with their engines have been in service for a considerable time. Obviously if the air compressor can be eliminated and no corresponding disadvantages accrue, solid injection must gain universal adoption.

The Success of Solid Injection

In the meantime, remarkable success has been attained with the first Vickers engined motorship built since the war (the *Narragansett*) in which this system is utilized. It is not often that owners go out of their way to state this fact, but when the second similar ship was launched for the Anglo American Petroleum Company a short time ago, Mr. F. E. Powell, chairman of this firm, stated that the motorship was successful in every way and was only burning about one-third of the amount of fuel used in a corresponding vessel fitted with oil-fired boilers.

The new ship just launched is the *Seminole*, and she is exactly similar in every respect to the first vessel, the *Narragansett*, carrying 10,500 tons of oil fuel at a speed of 11 knots and being fitted with two 1,250 brake horsepower Vickers Diesel engines of the four cycle solid injection type. A curi-

ous point in the design of these motors is that instead of adopting the system now commonly employed, of fitting one fuel pump for each cylinder, there are four plunger pumps for each engine, delivering into a common rail from which the individual fuel valves receive their supply. This arrangement has lately come in for some criticism, but Vickers defends it as having proved entirely satisfactory on submarine engines. It may be noted also that Doxfords are more radical in their design, since they employ only one fuel pump of relatively large size, discharging the oil at 7,000 pounds per square inch through a distribution box whence pipes are taken to the separate fuel valves.

Harland and Wolff's Big Programme

To those who are not aware of the recent development in motorship building in Great Britain the programme of Harland and Wolff, the well-known Glasgow and Belfast shipbuilders, for 1921 will come somewhat as a surprise. During the course of the year it is hoped to complete four 14,000-ton ships for the Glen Line, five 10,000-ton vessels for the same owners, three 12,000-ton and one 10,000-ton craft for the Pacific Steam Navigation Company, one 12,000-ton ship for the Bibby Line, and one 10,000-ton vessel for Lamport and Holt, making a total of fifteen ships in all with a deadweight tonnage of 174,000 tons equipped with machinery of 68,800 indicated horsepower. It is to carry out this policy that the two enormous engine building works have been equipped on the Clyde, probably capable of an output of at least three times as many oil engines as is possible in any other existing works.

The second of the 14,000-tonners, the *Glenapp,* was completed in December and followed her sister ship, the *Glenogle,* on the Eastern run. No trouble whatever has been experienced with the 3,200 indicated horsepower engines installed in the first vessel, and it is anticipated that larger sets, probably of about 4,000 indicated horsepower, will be built, increasing the cylinder diameter to a considerable extent and using only six cylinders instead of eight. Thus the four cycle motor is approaching the two cycle set in cylinder output, and the struggle for supremacy between the two types will seemingly be very acute.

The Swedish East Asiatic Company, one of Mr. Dan Brostrom's concerns, has just placed an order for a large motor vessel of a well-known Scandinavian type, carrying 10,400 tons of cargo and fitted with two 2,000 indicated horsepower, six cylinder engines. This is practically similar to the three vessels now operated by the Transatlantic Company and which are stated to have proved the most successful vessels ever built for this firm, maintaining a regular sea speed of 12 knots on a fuel consumption of not more than 12 to 13 tons per day. The dimensions of these vessels are:

Length between perpendiculars	425 feet
Beam	56 feet
Depth	38 feet
Draft	27 feet 6 inches

Their general design can be noted from the plans (Fig. 1).

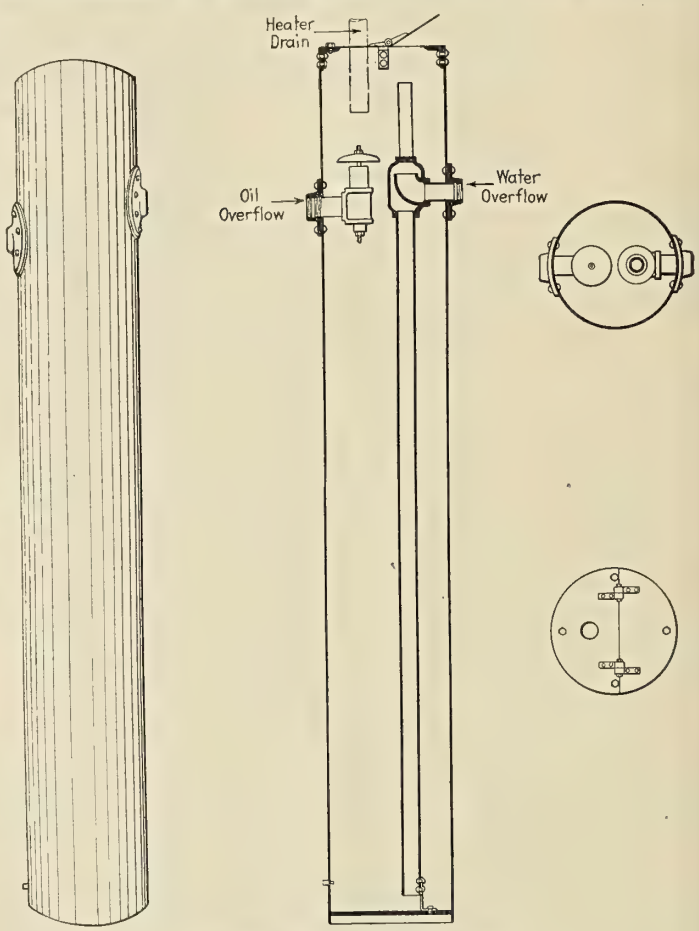
The Supply of Oil Fuel

Needless to say, Lord Pirrie's remarks on his return from America on the subject of the supply of oil fuel, which have been published broadcast, have excited widespread attention, since Lord Pirrie is, at the same time, the largest builder of motorships and controls more craft of this class than any other British shipowner. He states quite frankly that to use oil under boilers is wrong in principle and should be avoided except on express passenger liners, but he advises shipowners to be careful about adopting motor vessels unless they are assured of their oil supplies. These are reasonable statements, but the oil companies have not been long in pointing out that there should be no difficulty in providing all the oil required for motor vessels, no matter how rapidly the number may grow. The chairman of the Anglo American Oil Company and Sir Chas. Greenway, the head of the Anglo-Persian Oil Company, are both equally emphatic upon this point and, moreover, both agree with Lord Pirrie that oil should be used in motor vessels and not in oil fired boilers on steamships. Sir Chas. Greenway stated that, whereas now there were probably not more than 10,000,000 tons of oil available outside the countries in which it was produced, in two or three years time this amount would have increased to 50,000,000 tons, which is equivalent in power production, if used in Diesel engines, to 175,000,000 tons of coal.

On all sides, therefore, it would appear that there is an optimistic spirit in regard to the future supplies of liquid fuel for motorships, while the view is widely expressed that as soon as the tanker shortage is remedied, which will probably be the case within the course of the next twelve months, not only will there be an enormously increased supply of oil fuel available, but that its price will be considerably diminished. This is not merely the opinion of the buyer whose wish might be father to the thought, but the view has been publicly expressed by those in control of some of the leading oil concerns.

New Babcock and Wilcox Oil Separator

A DEVICE which not only detects oil leakage and separates oil from water, but also discharges the oil and water separately, is being brought out by the Babcock & Wilcox Company, 85 Liberty street, New York. The combination detector and separator was designed by Mr. John Coleman, their chief operating engineer.



Details of New Oil Separator

In operation, the simplicity of the separator and its automatic operation are regarded as its crowning features. Heretofore on oil burning ships oil leakage was returned from the heaters to an observation tank, where, if the engineer discovered it soon enough, he could avoid its getting into the boil-

ers, begin a search for the leak and repair it before material damage was done. On the other hand, if not noticed promptly, the oil leakage was returned with the feed water into the boilers, where it had extensive capacity for damage.

The Babcock & Wilcox separator consists of a 1-foot 4-inch by 9-foot 3-inch tank (approximate standard size) with two outlets, one for water overflow and one for oil overflow. It will be noted that the oil overflow is 1 inch higher than the water overflow. Oil returning with the drains from the fuel oil heaters will be deposited on the surface of the water within the separator, where it will be accumulated until the difference in the weight of the oil and the weight of the water will bring about a height difference of 1 inch, and should more oil enter the separator it will overflow through the oil outlet. Water returning through the separator will overflow at the lower level after passing up the pipe leading to the water overflow, this operation being continuous from this point on.

It will be further noted that as the operation of the separator is automatic it will not require any attention on the part of the engineers in order to eliminate oil getting ino the boilers, as at present is said to be the case with other devices now in use.

A receptacle under the oil overflow piped to the suction of the oil pump makes reclamation of oil possible. The separator has been given exhaustive tests and proved satisfactory. Patents have been applied for.

Marine Steam Practice*

BY ESKIL BERG†

AT the present time in this country 200 pounds steam pressure seems to be the limit of pressure considered. The reason, no doubt, is that this pressure seems to be the limit at which the old reliable Scotch boiler can be used. In new passenger vessels now being considered, 275 pounds pressure at the boilers is going to be used, but, of course, watertube boilers have to be employed.

Superheat

Superheat has been used for many years by European shipowners—in fact, where economy is desired, superheat must be used. While superheat can be, and is now being, used by thousands of reciprocating ships, giving from 10 to 15 percent saving in fuel, the engine must be of special design to operate satisfactorily. All the auxiliary engines must also be of special design to give reliable operation, or else they must be operated by dry steam led to them by special piping, the steam being taken from the boiler before it reaches the superheater coils.

This, of course, is a make-shift and, besides, when we consider that from 25 to 35 percent of all the steam from the boilers is used to drive the auxiliaries, it is a terrible waste of fuel.

Steam turbines are particularly well adapted for superheat. The friction loss inside the turbine is reduced to a minimum by the introduction of superheat. This means long life, smooth running and economy.

In the Curtis type of turbine there is a gain of practically 1 percent for every 12 degrees of superheat. In other words, the steam consumption is reduced 16.7 percent with 200 degrees of superheat, as will be explained later. This in practice means practically the same amount in fuel consumption.

In connection with engines using superheat it must be remembered that every steam locomotive, operating on the main railroad line, is using very highly superheated steam (temperature of steam, 650 to 700 degrees). The economy by the use of superheat on locomotives has proven itself so great that it is to-day considered absolutely necessary. How much longer can the steamship owner overlook this great saving in fuel?

Auxiliaries

The auxiliaries of the type now used on board ships consume from 25 to 40 percent of the total steam generated by the boilers. This is a terrible waste of steam, which means fuel.

This exhaust steam is from three to four times more than that required to heat feed water and the surplus is allowed to exhaust into the condenser.

The energy of this steam is thus thrown away and, in some cases that have lately come to my notice, amounts to as much as 500 or 600 horsepower.

This auxiliary steam overloads the condenser 50 to 75 percent, and thus there is bound to be inferior vacuum, also increased power required to drive the circulating pump, condensate pump and air pump.

No power house on shore can afford to use such inefficient auxiliaries.

The simplest solution is, of course, to drive as many of the auxiliaries as possible by electricity, with power supplied from an efficient type of turbine that is designed to handle highly superheated steam. In older ships now operating the surplus exhaust steam should be admitted to a lower stage in the turbine, thus producing additional power which means lowering the temperature of the steam before it reaches the condenser, thus reducing the load on the condensing equipment.

High Steam Pressure

The effect of high steam pressure was also discussed and showed how enormous saving could be obtained by its introduction. In fact it was shown how, by the use of steam at 800 to 900 pounds pressure, and 150 degrees superheat, results could be accomplished that would compare favorably with Diesel engines.

High Vacuum

Mr. Berg explained in detail the importance of maintaining a high vacuum when steam turbines were used as prime movers.

The energy in one pound of steam between 28 inches and 29 inches of vacuum is as much as between 200 pounds steam pressure and 125 pounds. In other words, it is just as wrong to operate the turbine with 28 inches of vacuum when 29 inches can be obtained, as it would be to operate the boilers at 125 pounds steam pressure when the boilers were supposed to carry 200 pounds.

* Abstract of lecture delivered at recent meeting of the Ocean Engineers Beneficial Association No. 80, New York.

† Turbine Engineering Department, General Electric Company, Schenectady, N. Y.

Lloyd's Shipbuilding Returns

ACCORDING to the returns compiled by Lloyd's Register, which only take into account vessels of 100 tons gross and upwards, there were 921 merchant vessels of 3,708,916 gross tons under construction in the United Kingdom at the close of the three months ended December 31, 1920. In September, 1920, the corresponding figures were 961 vessels of 3,731,098 gross tons. The tonnage now under construction in the United Kingdom is about 22,000 tons less than that which was in hand at the end of the last quarter.

In shipyards abroad, 1,509 vessels of 3,470,826 gross tons are under construction, making the grand totals for the whole world 1,980 vessels of about 7,176,778 gross tons, or about 385,000 tons less than the September total.

The present figures for the United Kingdom include 64 steamers and motor vessels of 422,553 gross tons, which are intended to carry oil in bulk. Of the total number of vessels under construction, 4 steamships are between 10,000 and 12,000 tons, 28 steamships are between 12,000 and 15,000 tons, 25 steamships are between 15,000 and 20,000 tons and 7 steamships are between 20,000 and 25,000 tons.

Merchant Marine Association Holds Convention

Prominent Men Discuss Policies and Legislation Necessary to Aid the Development of the American Merchant Marine

THE annual convention of the National Merchant Marine Association was held at the Hotel Washington, Washington, D. C., January 20-21. Senator Joseph E. Ransdell, president of the association, presided and delivered the opening address. Members of the Mississippi Valley Association and the South Atlantic States Association attended the convention and contributed several valuable papers relating to the shipping situation.

Senator J. E. Ransdell

Senator Ransdell in his opening address urged the repeal of the Panama Canal tolls on American vessels, support for the Shipping Board, a fair trial for the Merchant Marine Act of 1920, and some form of aid to American shipping to offset the lower operating costs of foreign competitors.

The senator stated that our coastwise commerce is purely a domestic matter and whether or not such commerce paid tolls for passage through the Panama Canal should be of no concern to foreign lands. Referring to the Merchant Marine Act, the senator stated that he was sure the vast majority of the people are disposed to give it a fair trial. He thought that it was the duty of Congress to develop advantages that would offset the burdensome obligations that ship operators have to assume in competing with the merchant fleets of other nations.

Senator Wesley L. Jones

Senator Jones, chairman of the Senate Committee on Commerce and author of the Merchant Marine Act of 1920, made the charge that British interests have been carrying on a campaign for years to destroy our merchant marine. In support of these charges the senator submitted copies of a twenty-year written agreement between the British Government, the International Mercantile Marine Company and British shipping companies in which the International Mercantile Marine Company contracts to pursue "no policy injurious to the British mercantile marine or the British trade." According to this agreement, the Lord High Chancellor of Great Britain shall be the sole judge of whether the policies of the International Mercantile Marine Company are favorable to British shipping or not.

Copy of Agreement

Copy of agreement (dated August 1, 1903) between the Admiralty and the Board of Trade, the International Mercantile Marine Company and the Oceanic Steam Navigation Company Limited, Frederick Leyland & Company (1900), Limited; the British and North Atlantic Steam Navigation Company Limited; the Mississippi and Dominion Steamship Company, Limited; the Atlantic Transport Company Limited, and the International Navigation Company Limited.

An agreement made the first day of August, 1903, between the commissioners for executing the office of lord high admiral of the United Kingdom of Great Britain and Ireland and the Board of Trade (for and on behalf of his Majesty's Government); of the first part; the International Mercantile Marine Company (formerly known as the International Navigation Company), being a corporation incorporated and registered under the laws of the State of New Jersey, in the United States of America, which company is hereinafter referred as to *The American company*, of the second part, and the Oceanic Steam Navigation Company Limited; Frederick Leyland & Company (1900), Limited; the British and North Atlantic Steam Navigation Company Limited; the Mississippi and Dominion Steamship Company Limited; the Atlantic Transport Company Limited, and the International Navigation Company Limited of the third part.

WHEREAS, the party of the second part owns a controlling interest in the shares of the International Navigation Company Limited, which owns a majority of the shares of the other companies parties of the third part;

And Whereas the term *the association* hereinafter used means the parties hereto of the second and third parts, and also includes any other company, corporate or unincorporate, partnership, body, or person, whether British, American, or other foreign, which by any arrangement is admitted to or brought under the control of the association or any of its constituent parts for the time being;

And Whereas the parties hereto of the third part are hereinafter referred to as *the British companies included in the association;*

And Whereas in the month of September, 1902, an agreement substantially to the effect of the provisions hereinafter contained was negotiated and made by and between his Majesty's Government and the American company, acting on behalf of the association;

And Whereas it is considered desirable that such agreement as last aforesaid shall be embodied in a formal instrument, to be executed not only by the American Company, but also by the British companies included in the association;

Now, these presents witness that in consideration of the stipulations hereinafter contained on the part of the American company and the British companies included in the association, the parties of the first part hereby undertake as follows:

1. The British companies included in the association shall, so long as the stipulations on their part and on the part of the American company hereinafter contained are duly observed, continue to be treated as heretofore on the same footing of general equality with other British companies in respect of any services, naval, military, or postal, which his Majesty's Government may desire to have rendered by the British mercantile marine; provided that nothing in this agreement contained shall extend to vessels of uncommercial speed which his Majesty's Government may specially require to be constructed and which are primarily designed for service in time of war.

And these presents also witness that in consideration of the undertaking hereinbefore contained on the part of the parties hereto of the first part and the American company and the British companies included in the association hereby agree as follows:

2. The British companies included in the association shall be and continue to be British companies, qualified to own British ships, and a majority at least of their directors shall be British subjects.

3. No British ship in the association, nor any ship which may hereafter be built or otherwise acquired for any British company included in the association, shall be transferred to a foreign registry (without the written consent of the president of the Board of Trade, which shall not be unreasonably withheld) nor be, nor remain upon a foreign registry. Nothing shall be otherwise done, whereby any such ship would lose its British registry or its right to fly the British flag.

4. British ships in the association, and ships that may hereafter be built or otherwise acquired for any British company included in the associaton, shall be officered by British subjects, and as regards their crews shall carry the same proportional number of British sailors of all classes as his Majesty's Government may prescribe or arrange for in the case of any other British line engaged in the same trades.

5. Subject to the existing agreement between the Admiralty and the Oceanic Steam Navigation Company Limited, and without prejudice to the provisions therein contained; the American company and any British company included in the association shall sell, or let, or hire at any time during the continuance of this agreement to the Admiralty, when required to do so by the Admiralty, any British ship in the association; and any ship hereafter to be built or otherwise acquired for any British company included in the association which the Admiralty may from time to time select. The terms of purchase or hire, if not otherwise agreed on, shall be similar to those contained in the existing agreement aforesaid.

6. At least a moiety of the tonnage built and at least a moiety of the tonnage otherwise, acquired for the association in each successive period of three years (commencing from the date of this agreement), including a reasonable proportion of the faster classes of vessels, shall be built or acquired, as the case may be, for British companies included in the association and shall be registered as British ships. There shall not be reckoned in acertaining the moiety of the tonnage so built or otherwise acquired; (a) vessels of the exceptional class referred to in article 1, which may be constructed by special arrangement with the Government of the United States of America; (b) any vessels not already in the association purchased for the association from owners other than British subjects or American citizens or subjects or companies or bodies subject to a British or American jurisdiction, provided that such last-mentioned vessels are existing ships which have been running for at least two years prior to the contract for purchase, and have not been built or acquired directly or indirectly for the association.

7. If at any time hereafter, any British company (not being a party hereto), or any British partnership, body, or person, shall be admitted to or brought under the control of the association or any of its constituent parts for the time being, then, and in every such case, subject and without prejudice to any agreement then existing between such company, partnership body, or person and his Majesty's Government, and subject and without prejudice to any agreement which may be made in view of such admission or inclusion between the American company, or other person or body acting for the association, on the one hand, and his Majesty's Government on the other hand, all the provisions of these presents shall inure for the benefit of and bind such company, partnership, body, or person, as the case may be, in like manner as if such company, partnership, body, or person, had been a party hereto of the third part, and had been comprised in the expression "The British companies included in the association," as used in this agreement, and, except with the consent of his Majesty's Government, no such British company, partnership, body, or person as aforesaid shall be admitted to or brought under the control of the association or any of its constituent parts for the time being otherwise than upon the terms specified in this clause.

8. If at any time hereafter during the continuance of this agreement any other company, whether corporate or unincorporate, partnership, body, or person, whether British, American, or other foreign, shall be admitted to or brought under the control of the association or any of its constituent parts for the time being, the association shall give notice thereof to his Majesty's Government, and shall furnish all such particulars with regard to terms, parties, or otherwise as the Government may reasonably require.

9. The American company and the British companies included in the association and any British company, partnership, body, or person hereafter admitted to or brought under the control of the association, or any of its constituent parts, for the time being, will forthwith and from time to time do and cause to be done all such further acts, and execute or cause to be executed all such further documents, and take all such steps as may be necessary to give full legal and binding effect to this agreement.

And these presents lastly witness that it is hereby mutually agreed as follows:

10. This agreement shall have effect for twenty years from the 27th September, 1902, and shall continue in force thereafter subject to a notice of five years on either side (which may be given during the continuance of this agreement) provided that his Majesty's Government shall have the right to terminate this agreement at any time if the association pursue a

policy injurious to the interest of the British mercantile marine or of British trade.

11. This agreement shall be construed and take effect as a contract made in England and in accordance with the law of England. The American company hereby irrevocably appoints the chairman for the time being of the British committee of the association, for if there be no such chairman, then each and every British company in the association to be the agent or agents in England of the American company, for the purpose of accepting service on behalf of the American company of any process, notice, or other document in respect of any matter arising out of this agreement; and service of any such process, notice, or document on such chairman or company as aforesaid shall be deemed to be good service on the American company. Any notice or document sent by registered post addressed to the American company at No. 22 Old Broad Street, London, or to the register office of any British company in the association, shall also be deemed to have been duly served on the American company.

12. In case of any difference as to the intent and meaning of this agreement, or in case of any dispute arising out of this agreement the same shall be referred to the Lord High Chancellor of Great Britain for the time being, whose decision, whether on law or fact, shall be final.

As witness the hands and seals of two of the before-mentioned commissioners and the seal of the board of trade, parties hereto of the first part, and the corporate seals of the parties hereto of the second and third parts.

Signed, sealed, and delivered by Admiral Walter T. Kerr, G. C. B., and Rear-Admiral W. H. May, M. V. O., being two of the commissioners for executing the office of lord high admiral of the United Kingdom of Great Britain and Ireland in the presence of:

Walter T. Kerr (L. S.)
W. H. May (L. S.)

William G. Perrin,
Admiralty clerk.

The seal of the Board of Trade was hereunto affixed by the direction of the president of the Board of Trade in the presence of—

G. W. Balfour (Seal of the Board of Trade.)

R. J. Lister,
Board of Trade librarian.

The seal of the International Mercantile Marine Company was hereunto affixed in the presence of—

C. E. Dawkins, director. (Seal of the International
C. R. Jeeves, assistant secretary. Mercantile Marine Company.)

The common seal of the Oceanic Steam Navigation Company, Limited, was affixed in the presence of—

S. Bruce Ismay, director. (Seal of the Oceanic Steam
James C. Farrier, secretary. Navigation Company, Limited.)

The seal of Frederick Leyland & Company (1,900), Limited, was hereunto affixed in the presence of—

A. Stephens, secretary. Hy. Wilding, Walter Glynn, directors. (Seal of Frederick Leyland & Company (1,900), Limited.)

The seal of the British and North Atlantic Steam Navigation Company, Limited, was hereunto affixed in the presence of—

Wm. J. Edwards, secretary. Hy. Wilding, David Richards, directors. (Seal of British and North Atlantic Steam Navigation Company, Limited.)

The seal of the Mississippi and Dominion Steamship Company, Limited, was hereunto affixed in the presence of—

Wm. J. Edwards, secretary. Hy. Wilding, David Richards, directors. (Seal of the Mississippi and Dominion Steamship Company, Limited.)

Signed pursuant to resolution of the board.

Arthur A. Hillen, secretary. Charles F. Terrey, Fred W. May, directors. (Seal of the Atlantic Transport Company, Limited.)

The seal of the International Navigation Company, Limited, was hereunto affixed in the presence of—

H. Pearce, secretary. Hy. Wilding, John E. Willett, directors. (Seal of the International Navigation Company, Limited.)

Senator Jones declared that because the International Mercantile Marine owns the American Line which flies the American flag, in addition to its regular fleet, controls approximately forty vessels leased from the Shipping Board, all of the ships are subject to the terms of the contract and therefore are actually operated in the interest of the British Government and British trade. As the British shipping center is in New York, Senator Jones said, the British shipping men are in accord with the eastern trunk lines which seek to cancel the present equalization of export freight rates from Central Freight Association territory to Gulf and South Atlantic ports.

"The present equalization, for the first time," said Senator Jones, "establishes the principle that American foreign commerce may best be developed and extended by the establishment of new foreign trade routes by the United States Shipping Board, and in furtherance of this movement that every American export shipper should have the right, without discrimination by the railroads, to choose the port through which his business can be handled most expeditiously and economically."

P. A. S. Franklin Makes Statement

Following the address of Senator Jones, P. A. S. Franklin, president of the International Mercantile Marine Company, rose and asked Senator Ransdell, president of the Association, for a moment to reply during the presence of Senator Jones.

"As for the International Mercantile Marine Company, the Senator is unfair to us. All of these agreements to which he refers have been before the Shipping Board and have been approved. Judge Payne, when he was chairman of the Board, passed upon them and said they were quite satisfactory.

"If you will read these documents in view of the fact that the company owns large British property, you will find that there is also an unusually large protection for American interests.

"Let me recall also that at one time we had our British property sold to British subjects. We were about to close the deal when the President of the United States asked us not to consummate it. Our object was to get money for investment in American ships. Do we get no credit for what we have done? Moreover we are the only company which have brought over vessels from the British flag to American registry.

"It is very unfair for a Senator of the United States to get up here before this association and make an incorrect statement. Under the British law any tonnage owned by a foreign corporation and operated under the British flag must be maintained at the same strength as when it was taken over or it is subject to confiscation.

"The International Mercantile Marine is absolutely American. There are none but Americans on its board of directors. More than ninety percent of our shares are owned by Americans. We have invested in American shipping, vessels obtained from the Shipping Board. We have transferred a 16,000-ton ship from the British to the American flag. When the country entered the war and ships were requisitioned, we were the first company to sign the requisition order."

Admiral W. S. Benson

Admiral Benson, chairman of the United States Shipping Board, prefaced his remarks with a statement that he did not know until a couple of days ago of the agreement entered into between the British Government and the International Mercantile Marine Company, that he was not in sympathy with it, and that as chairman of the Shipping Board he would begin an investigation. He said that the American merchant marine must be 100 percent American and warned against insidious attacks from foreign sources.

"Despite proposals that the United States withdraw from the shipping business," declared Admiral Benson, "the Shipping Board is solemnly charged by the law of the land to establish a permanent merchant marine for the country. Consequently, it was said, the Board must conform to the Shipping Act so as to provide for an American permanent merchant marine, under private ownership sufficient to carry the greater part of our commerce."

Services rendered the country's foreign commerce by an adequate merchant marine were illustrated by Admiral Benson in comparing the percentage of American commerce carried in American bottoms at present with preceding periods. Foreign commerce of the country carried in American flag ships in 1920, was estimated by Admiral Benson at 42.7 percent, the remaining 57.3 percent being carried in foreign bottoms. In comparison, Admiral Benson showed that prior to the war, taking 1910 as a typical year, American foreign commerce carried in American vessels totalled only nine percent, the remainder carried wholly by foreign ships.

Admiral Benson defended the sale price policy of the Shipping Board pursued in the sale of the Government owned merchant ships to private interests. The Shipping Board, he said, must move slowly in anything it does in connection with changes in the sale policy now in force, "for this policy was determined with all these things laid down by law in mind."

MATTHEW HALE

Matthew Hale, president of the South Atlantic States Association, stated that the Merchant Marine Act contained two most important policies—self-defense and the encouragement of foreign commerce. He stated that foreign commerce must be developed in the interests of the shippers rather than the shipowners. The men in the interior must be able to sell their products and the Government should give its co-operation from the factory to the consumer.

Mr. Hale pointed out that, if each port would build up a foreign trade for the production of its own back country, the number of people interested in shipping would be greatly increased and that it would then be much easier to get people to invest in ships. He attacked the concentration of export shipments through the single port of New York and declared that a change must be made to provide new outlets to foreign markets. New export ports should be established on the South Atlantic and Gulf coasts, and the export rail rates to these ports should be kept equitable.

WILLIAM E. HUMPHREY

Former Congressman Humphrey of Washington urged the repeal of Panama Canal tolls on American vessels. He stated that no one thing would do so much to increase the trade of the Pacific coast as the repeal of these tolls and that every toll levied on American ships passing through the canal is a direct tax on our commerce.

Mr. Humphrey claimed that giving free passage to American ships would not violate any treaty obligations because America had acquired title to the land upon which the canal is constructed, has done all the work and paid all expenses and has relieved England of all responsibility for construction and maintenance so that the Hay-Pauncefote treaty had no application in law or equity to this matter.

J. W. POWELL

J. W. Powell, vice-president of the Bethlehem Shipbuilding Corporation, stated that American shipbuilding and shipowning will live or die together. In regard to shipbuilding he declared that even with superior American efficiency and possible lower cost of certain materials, the future of the industry depended upon some sort of assistance from the Government, such as is extended to other business by the tariff.

In speaking of the problems facing the shipbuilder, Mr. Powell stated that in ship construction it is estimated that 40 percent is labor, 40 percent materials and 20 percent overhead. Shipbuilding is not manufacturing, but assembling and building in which hand labor takes the largest part and this fact makes competition with foreign labor more severe.

Commenting upon the assistance needed by the shipbuilders, Mr. Powell said: "The Merchant Marine Act of 1920 has all the means necessary to accomplish that result. It is useless to talk of more legislation until the Act is tested. It is necessary to have appointed a real Board that will command the respect of the American people. In saying this, I do not intend to depreciate the present Board, but it is understood that the existing commissioners will not be confirmed and I am speaking of the new members to be named. The Shipping Board and the Emergency Fleet Corporation should be separated and the Board allowed to attend to its duty as a regulatory body and not to devote its time to shaking over the bones of the dead past.

COMMANDER R. D. GATEWOOD

Commander Gatewood, director of the division of construction and repair, Emergency Fleet Corporation, asked for the co-operation of the shipping interests of the country with the Shipping Board in curtailing operating and repair expenses to a minimum. He stated that the bill for repair work alone had amounted to $75,000,000 per annum divided as follows: 10 percent abroad, 10 percent in navy yards and 80 percent in home yards.

Commander Gatewood advocated a policy of no alterations on government ships and no repairs abroad except in case of emergencies. He declared that the ship's forces should make all possible repairs and that while he had reduced the repair bill to about $4,500,000 per month, it could be still further reduced.

HOMER L. FERGUSON

Homer L. Ferguson, president of the Newport News Shipbuilding & Dry Dock Company, pleaded for government protection for the shipping industry, declaring that some form of subsidy or preferential treatment must be given the merchant marine. "It is unfortunate," said Mr. Ferguson, "that the President should have cast out the crux of the Merchant Marine Act, Section 34, which directs the abrogation of commercial treaties. In my humble judgment he should have executed the law. To say that discriminatory duties will lead to recrimination and retaliation may be true, but remember this, other nations cannot discriminate against us in trades in which they have no part. In the first six months of 1920 in trade with Great Britain we carried 12 percent of our imports and 25 percent of our exports. It does not seem that we have too many ships in that trade.

"The objection of a plain subsidy," said Mr. Ferguson, "is that it must be re-enacted each year and thus become the football of politics. Whatever scheme is devised should have the elements of permanence. We must have a policy that we can tie to as it takes time to build a merchant marine and a seafaring nation."

P. A. S. FRANKLIN

P. A. S. Franklin, president of the International Mercantile Marine Company, said that until the shipping business is put on sound lines by the Government and a fixed policy regarding the position of private owners in permanent routes is established, it is my opinion that nothing can be accomplished in the way of selling these steamers in any large numbers and properly establishing American corporations in the foreign trades of the world.

Recommendations made by Mr. Franklin were that the Shipping Board establish mail, passenger and cargo routes, carrying proper compensation for operating companies with the object of inducing private owners to buy the steamers and maintain the various trade routes.

That the United States should be divided into three sections, North Atlantic, South Atlantic and Gulf, and Pacific Coast, possibly North and South, for the development of trade routes; only companies and individuals who have demonstrated their ability to operate ships satisfactorily should be selected by the Shipping Board as operators; giving preference to private owners now in such trade routes, or who have purchased Government ships, and that only one firm should operate Government tonnage in a given route.

That a careful survey be made of the Government-owned tonnage to determine which is most suitable for the mail, passenger and cargo routes to be established, reserving the remaining tonnage for bulk cargo and tramp usage not competing with private lines.

That operating companies enter into conference agreements as to rates, etc., for the account of the Shipping Board, and ships withdrawn from one trade and placed in another, dependent upon the movement of traffic in the various routes.

That the operating companies have the option of purchasing the steamers in service at the price at which the Shipping Board at that time is selling, and in case of purchase, the

(*Continued on page* 166)

New York Marine Exposition Stimulates Interest in Shipbuilding and Shipping

Unusual Exhibits Draw Crowds at Second Exposition in New York Under Auspices of National Marine League

THE third National Marine Exposition opened in Grand Central Palace, New York City, at 2 P. M., Monday, January 24. American shipping, American ship operation and American appliances and inventions were displayed on the main and mezzanine floors of the Palace in what was considered one of the most elaborate and comprehensive marine exhibitions ever placed before the public, continuing from the opening hour on Monday until Saturday, January 29.

Opening Ceremonies

In the absence of President-elect Warren G. Harding, who was unable to be present, President H. H. Merrick, of the Mississippi Valley Association, delivered the opening address, which was responded to by P. H. W. Ross, president of the National Marine League of the United States, the organization which sponsored the exhibition. An honor guard of sixty uniformed men from the schoolship *Newport,* under Captain Bayliss, acted as escort to Mr. Merrick for the opening ceremonies.

A feature of "Marine Week" was the singing of chanteys by a dozen or more old sailors from Sailors' Snug Harbor. These old men recalled to the present age the days of sixty years ago when America was foremost in the world's maritime trade. Many of the old-timers are over eighty years old and some of the songs they sang were known to few of the men who follow the sea at present.

Programme of the Week

Although no set programme was arranged for the week, each day was set aside for a special occasion. Monday, the opening day, was designated as Officials' Day, when the officers of the League were on hand for participation in the opening ceremonies and inspection of the exhibits.

Tuesday was National Marine League Day, and in the evening the League held its ninth annual banquet at the Hotel Commodore. Among the prominent shipping men and speakers attending the dinner were the following:

Guests at the Banquet

August Belmont, chairman, board of trustees of the National Marine League; Frank C. Munson, president of the Munson Steamship Lines and a trustee of the National Marine League; Honorable William M. Calder, United States Senator from New York state; George J. Baldwin, president of the American International Corporation; P. A. S. Franklin, president of the International Mercantile Marine Corporation; W. Averill Harriman, chairman of the board of directors of the United American Lines, Inc.; William L. Todd, L.L.D., president of the Todd Shipyards Corporation; Oscar L. Gubelman, of Knauth, Nachod & Kuhne, and a trustee of the League; Captain Kermit Roosevelt, president of the recently organized Roosevelt Steamship Company. Senator W. L. Jones, author of the Merchant Marine Act, was unable to be present.

Wednesday was set aside as Engineers' Day; Thursday, Society Day; Friday, Mercantile Marine Day, and Saturday, Old Salts' Day.

Moving Pictures and Lectures

An afternoon and evening motion picture schedule was arranged for each day of the show, in many cases lectures and slides being used by the exhibitors. The schedule included the following:

Wilson Welder & Metals Company, lecture and slides; National Life Preserver Company, motion pictures of life preserver suits; Ocean Marine Engineers' Beneficial Association, No. 80, address "Ocean Marine Engineers"; Submarine Boat Corporation, shipbuilding and shipping film; Babcock & Wilcox Company, "Seamless Tubes"; General Electric Company, "The Queen of the Waves" and "Revelations"; Columbian Rope Company; Sperry Gyroscope Company; Baltimore Dry Docks & Shipbuilding Company; International Mercantile Marine Lines, "S. S. *Olympic*" and "Under the Eagle's Wing"; Submarine Signal Company; Mitchell Ship Salvage Company, "The Newest Salvage"; Plymouth Cordage Company, "The Story of Rope."

Everything pertaining to ships and shipbuilding, marine inventions and ship operation was on exhibition, nearly 200 exhibitors being listed.

The next show, officials of the League announced, will be held about the first of May at New Orleans, La.

EXHIBITS AT NEW YORK MARINE EXPOSITION

Alberger Pump & Condenser Company, 140 Cedar Street, New York.—2,000-horsepower Alberger occluder for removing air from surface condensers; 35-horsepower auxiliary impulse turbine; feed water heater; high and low pressure expansion joints.

Aluminum Cooking Utensil Company, New Kensington, Pa.—"Wearever" aluminum wear.

American Balsa Company, 50 East 42d street, New York.—Section of a ship's deck upon which was mounted a set of Welin quadrant davits and Lundin standard lifeboats nested, davits fitted with non-toppling falls; sectional models showing typical Balsa wood insulation for refrigerator space aboard ship; new type of releasing gear for collapsible boats and a cabinet of miniature lifeboats and rafts and working models of davits, cranes, etc.; Balsa wood liferafts; surf boards and horseshoe life chairs; lifeboat winch and photographs of typical Balsa insulation and Welin davit and lifeboat installations.

American Blower Company, Detroit, Mich.—No. 5 Sirocco fan; 4-inch by 4-inch vertical steam engine; two small Sirocco utility ventilating sets; equipment for heating, lighting, ventilation and mechanical draft.

American Car & Foundry Company, 165 Broadway, New York.—Single electrode, single bolt heater with capacity of 60 bolts per hour; two electrode and three electrode rivet heaters having capacities of 200 and 300 rivets per hour respectively (all machines in operation).

American Chain Company, Inc., New York.—Chain, anchor chain and welding rods.

American Chain Ladder Company, 30 East 42d street, New York.—Chain ladders.

American Engineering Company, The, Philadelphia, Pa.—Steam windlasses and electro-hydraulic steering gear, also special Hele-Shaw pump; model of new type electric winch operated in conjunction with a model mast and boom arrangement; steering wheels and hand operated capstan.

American Manganese Bronze Company, Philadelphia, Pa.—Manganese bronze propeller blade, forged and bent while hot to demonstrate that a deformed blade can be restored by hot forging; 8-ton Y-casting for the Gilboa Dam, 42 inches by 30 inches by 30 inches, for the New York Board of Water Supply; semi-steel propeller blade broken under 50,000-pound load and manganese bronze blade which took a permanent set of ¼ inch under 60,000-pound load and blade of high tensile bronze which took a set of ¼ inch under 100,000-pound load; dry sand cast blade of metal melted in this company's electric appliances; high test manganese bronze rods; copper castings for switchboard work and a manganese bronze propeller blade from a 17-foot diameter wheel furnished the Merchant Shipbuilding Corporation; Hall bronze lifeline-throwing gun.

American Manufacturing Company, Brooklyn, N. Y.—Background occupied by painting of plant; coil of 10-inch bolt rope with red marker; pyramid of rope graduated from 18 inches down to ¼-inch diameter; samples of ratline, marline, hawsline and spun yarn; marine oakum; a length of bolt rope with Tuxpam gem applied to one end and a Turk's head at the other.

American Seamen's Friend Society, New York.—Library that was on Commander Peary's ship, the *Roosevelt;* colored slides of sea life, etc.

American Society of Marine Draftsmen, Philadelphia, Pa.—Blue prints and small drawing table.

American Steel Foundries, 30 Church street, New York.—Models and specimens of Dunn stockless anchors; model of new type anchor equipped with lock grip.

Asbestolith Manufacturing Company, 1 Madison avenue, New York.—Samples of Asbestolith ship decking with section cut away; samples of material applied to wood floors and stairways and to wooden decks.

Ashton Valve Company, Boston, Mass.—Gages, safety valves, gage testers, large steamship whistles.

Atlas Soot Blower Company, New York.—Soot blower.

Audel, Theo., & Company, 72 Fifth avenue, New York.—Books on marine and electrical engineering and naval architecture.

Babcock & Wilcox Company, 85 Liberty street, New York.—Moving pictures of the Pittsburgh Seamless Tube Company, showing manufacture of tubing; a full-sized sectional model of a B. & W. marine boiler; a full-sized sectional model of a B. & W. express type naval boiler; electric concentration indicator; boiler fittings; the first and the latest B. & W. oil burner installations; tractorscope showing slides of B. & W. installations; photographs of vessels equipped with B. & W. products, the new B. & W. oil separator and several performance charts.

Baltimore Dry Docks & Shipbuilding Company, Baltimore, Md.—Bow of ship with full crew of riveters at work, showing fitting up and riveting of a steel plate; model of 10,300-ton deadweight oil tanker; photographs of the plant.

Beaver Tile & Specialty Company, 442 West 42d street, New York.—Samples of colored cork tile and natural cork tile for floor.

Benjamin Electric Manufacturing Company, New York.—Telltale board in operation, watertight valves submerged in water, standard marine panel boards and fittings and standard lighting fixtures.

Benson Electric Company, Superior, Wis.—Electric control for steering gear; electric flash light signal for mast head.

Bethlehem Shipbuilding Corporation, Bethlehem, Pa.—First Weir feed water pump built in America exhibited (all American rights for Weir apparatus controlled by Bethlehem Shipbuilding Corporation, Ltd.); two Bethlehem-Weir fuel oil service pumps; Bethlehem duplex ram hydraulic telemotor set up for operation; sections of castings used in Weir pumps; Bethlehem-Dahl mechanical oil burning system; model of 12,500-ton deadweight oil tanker; display board showing parts used in Curtis turbines; models showing the features of each of the eight Bethlehem plants; samples of various types of ship fittings.

Bowman-Edson, M. K., Company, 65-67 Dey street, New York.—Model of bullet tube brush.

Boucher, H. E., Mfg. Company, 150 Lafayette street, New York.—Model of sulphur steamer *Herman Frasch;* schooner model; working models of yachts and power boats; miniature engines and boilers for experimental and demonstrating purposes; collection of standard fittings for ship models; model of commissary department on board battleship, made to ½-inch scale, showing galleys, messrooms, storerooms, etc.

Brown, A. Judson, & Company, 30 Church street, New York.—Chains and anchors.

Brunswick Refrigerating Company, New Brunswick, N. J.—Two-ton steam driven compressor with high pressure side completely connected; 8-ton compressor driven by piston valve steam engine; ¼-ton compressor with cylinder cut away to show moving parts. Exhibit of small parts used in Brunswick apparatus; 40-gallon scuttle butt or water cooler; 250-pound marine ice making set; 12-foot by 7-foot by 8-foot refrigerator with side cut away to show details of insulation and piping, etc.

Buzzini, Walter J., Inc., 505 West 21st street, New York.—Steam table, steamers, kitchen equipment.

Car Heating & Lighting Company, The, New York.—Electric heaters.

Coen Company, 50 Church street, New York.—Oil burning installation; pumping and heating outfit and firing fronts.

Columbian Bronze Corporation, 522 Fifth avenue, New York.—Bronze propellers.

Columbian Rope Company, Auburn, N. Y.—Large coil of 10-inch bolt rope; coils of smaller rope; display board of knots and splices; red, white and blue Columbian marker in silk displayed in background of booth; moving pictures showing the manufacture of Columbian rope.

Consolidated Shipbuilding Company, Morris Heights, New York.—Model of shipyard and small gasoline engine.

Cornell-Emery Company, 25 West Broadway, New York.—Color designs of saloon, smoking hall, reception hall and bedroom of first class passenger ship; portable combination settee which is convertible into upper and lower berths; display of high grade furniture for steamships, including English oak burle veneer table with inlay of walnut butt; walnut smoking room table with carved base; oak burle veneer cabinet; various types of chairs; collection of French Wilton rugs; model of first class suite; samples of carpet and linen; 2-ton carbon dioxide refrigerating machine.

Cory & Son, Inc., Charles, 290 Hudson street, New York.—Mechanical and electrical telegraphs, loud speaking telephones, voice tube apparatus complete; watertight and non-watertight fixtures; mechanical telegraph accessories; electric bells, buzzers, signaling apparatus; switches, plugs, receptacles; rudder angle indicators; navigator log, steering mechanism locking device, etc.

Crane Company, Chicago, Ill.—Valves and fittings; sectional models of various valves; complete model ship bathroom.

Crane Packing Company, Chicago, Ill.—Flexible metallic packing.

Cutting & Washington Radio Corporation, 6 West 48th street, New York.—Full size model of a radio room fully equipped; small gas driven generator set for home use and a radio transmitter.

Cutler Hammer Manufacturing Company, Milwaukee, Wis.—Capstan equipment, consisting of 45-horsepower motor with complete controlling equipment of contactor type; 3-horsepower steering gear control; photographs of 300-horsepower steering gear equipment; photographs of winch control, hydro-electric steering gear control, submarine control types of all kinds, etc.; 1,000- and 2,000-watt portable type ship air heaters.

Davidson Company, M. T., New York.—Vertical boiler feed pump and hydraulic ash ejector.

Debevoise Company, Brooklyn, N. Y.—Marine paints and "Dereka" metal paints.

DeLaval Separator Company, 165 Broadway, New York.—Oil purifier demonstrated in connection with a cruising gear, capacity 125 gallons per hour; steam and motor driven oil purifiers for central station and other power station work; smaller motor and steam driven purifiers for marine installations; samples of oil before and after passing through centrifugal separator.

DeLaval Steam Turbine Company, Trenton, N. J.—3,500-horsepower compound marine turbine set with high and low pressure turbine rotors shown with high speed reduction gears and low speed pinions; small cruising turbine with gravity oil system and oil purifier in operation; 10-kilowatt turbine driven generator; sectionalized 1½-horsepower lighting set with turbine speed of 50,000 revolutions per minute at turbine shaft and gear reduction 10 to 1.

Devoe & Reynolds Company, 101 Fulton street, New York.—Marine paints and varnishes.

Donnelly, William T., 17 Battery Place, New York.—Model of floating dry dock and models of barges.

Duparquet, Huot, Moneuse & Company, New York.—Electric stoves, ranges, urns, etc.

Durkee, Chas. H., & Company, New York.—Marine hardware, sounding machine, binnacle.

Durkee Manufacturing Company, Inc., New York.—Marine compasses and magnetic testing equipment.

Edson Manufacturing Company, Boston, Mass.—Diaphragm bilge pumps hand and power operated, new type diaphragms, steering gears and wheels, port lights.

Egan Corporation, K. Francis X., 22 Bergen street, Brooklyn, N. Y.—Cotton waste.

Electric Arc Cutting & Welding Company, Newark, N. J.—Portable arc welding machine; exhibition of welding within a steel cage seen through a dark glass window.

Electrose Mfg. Company, Brooklyn, N. Y.—"Arcover" insulators, wall bushings and insulated connectors, insulating knobs, handles, sheets, tubes, etc.; insulated turnbuckles, special forms of trolley wire suspension insulators, etc., distributor blocks, disks, switch bases and the like.

Estate of Adolph Starke, Brooklyn, N. Y.—Bolts, spikes, rivets, ventilator cowls, concrete inserts.

Fairbanks, Morse & Company, 30 Church street, New York.—100-horsepower oil engine; ½-ton ice plant; 1½-horsepower house and boat lighting set.

Federal Bending Machine Company, Bayonne, N. J.—Machine for bending pipe cold; samples of bent pipe.

Fire Detecting Wire Corporation, New York.—Fire detecting system.

Foster Marine Equipment Company, New York.—Superheater; photographs of ships equipped with Foster boilers and superheaters.

Fougera & Company, E., 90-92 Beekman street, New York.—Fino cream soap.

Fuller Company, George A., Wilmington, N. C.

General Electric Company, Schenectady, N. Y.—Working model of steam turbine electric drive installation connected to an actual ship control panel; rotating element of 2,500-horsepower turbine except the low speed gear; spring type thrust bearing; deck winch motor; two engine room motors for operating auxiliaries; one 4-kilowatt arc welding set; a 10-horsepower steam generating set with marine type switchboard; three 18-inch searchlights; running light telltale board with running lights; blinker key and light set; two marine type fans; two display boards, one with merchant marine cables and one with rotating turbine buckets. The entire display is actually operated except the turbine and deck winch motor.

Gillespie & Sons, Charles H., Jersey City, N. J.—Varnishes and enamels.

Globe Shipbuilding & Dry Dock Company, Baltimore, Md.

Gold Car Heating & Lighting Company, New York.—Electric heaters.

Goodrich Transit Company, Chicago, Ill.—Model of passenger steamer *Alabama.*

Gregory Galvanizing Works, Thomas, Brooklyn, N. Y.—Galvanized ship parts and fittings, including cowls, hand rails, shackles, small anchors, blocks, chain, cleats, chocks, spikes, etc.

Griscom-Russell Company, 90 West street, New York.—Reilly submerged type self-scaling evaporator, Reilly distiller, Reilly aerating filter, Reilly fuel oil heater, Reilly feed water heaters, multiwhirl oil cooler, G.R. strainers, G-R multiscreen grease extractor, Stratton separators, back pressure and by-pass valves, complete evaporating plant with all accessories piped up for operation.

Guarantee Exterminating Company, 400 Fifth avenue, New York.—Masks used in fumigating ships, literature, etc.

Hamlin Peeling Machine Company, 430 Eleventh avenue, New York.—Vegetable peeling machine.

Hamilton & Hansell, Inc., New York, and Superior Engineering Company, 15 Park Row, New York.—Sal-log, apparatus for giving the speed of ships by means of pitot tubes; liquid carbonic acid fire extinguishing system; Superior soot blower.

Hansen & Yorke Company, Inc., 88 Warren street, New York.—Quinn oil torches and burners, special machine bolts of all types, ship fittings, Yale & Towne blocks and hoists of all types up to 10 tons, and trolleys, diaphragm pumps and engine.

Hartmann, Charles, Company, 977-991 Dean street, Brooklyn, N. Y.—Model of midship portion of passenger vessel showing ventilation system for quarters.

Horne Manufacturing Company, Jersey City, N. J.—Watertight electrical fixtures, ship telegraphs, automatic running light indicator, cargo reflectors, voice tubes, Magnavox anti-noise marine telephone.

Hush, H. J. 36 West 60th street, New York.—Small gasoline engines driving winches, pumps and motorboats.

Hyde Windlass Company, Bath, Me.—Brown steam tiller; hydro-electric steering gear with telemotor and hand attachments; two 3,000-pound manganese bronze propeller blades and a number of smaller wheels including their stock wheel that drove the *Miss America* 77.83 miles per hour—the world's speed record.

Industrial Management, New York.

International Mercantile Marine Company, 9 Broadway, New York.—Nineteen-foot model of steamship *Olympic;* painting showing sectional view of *Olympic;* marine paintings of ships in the I. M. M. service leaving New York, in mid ocean, and nearing England.

International Nickel Company, The, 43 Exchange Place, New York.—Nickel, monel metal castings, rods, wire, forgings, blades for General Electric and DeLaval turbines and monel metal as used in Crane, Jenkins, Chapman and other types of valves.

Irving Iron Works, Long Island City, New York.—Section of platform and ship walkway of Irving subway treads and grating.

Jahncke Dry Dock & Ship Repair Company, New Orleans.—Photographs of plant and products.

Johnson, M. E., Inc., Edes, New York.—*Johnson's Steam Vessels.*

Kahnweiler's Sons, David, 260 Front street, New York.—Life saving equipment, jackets, life savers, models of lifeboats and rafts, cork fenders and gun.

Kelley Industrial Corporation, 37 Maiden Lane, N. Y.—Harrison emergency tube plug for Scotch boilers, Hodgson safety plug for watertube boilers.

Kinney Manufacturing Company, Boston, Mass.—Model of rotary plunger pump; pumps for handling heavy viscous products.

Locomotive Superheater Company, 30 Church Street, New York.—Section of marine firetube superheater; sectional model of Scotch boiler with superheater applied; display board of forged return bends; steam pipe heating coils showing application of forged return bends; feed water heater pump; electric pyrometer for temperatures up to 800 degrees F.; photographs of suerheaters applied to marine and stationary uses.

Long Island Soap Company, The, Brooklyn, N. Y.—Soap, metal polish and cleaning compounds.

Lord Dry Dock Corporation, 105 West 40th Street, New York.—Sketches of West New York and Providence, R. I., ship repair plants, model of 10,000-ton floating dry dock with U. S. S. *Oregon* in the dock, model of full rigged ship.

Luckenbach Steamship Company, 44 Whitehall Street, New York.—Sectional model of S. S. *Lewis Luckenbach;* model of new Weehawken, N. J. terminals; paintings of S. S. *Pleiades* and *Edward Luckenbach.*

Lunkenheimer Company, Cincinnati, O.—Valves, oil cups and grease cups.

McDougall, Alexander, Duluth, Minn.—Model of a canal-size ocean steamer, also model of the *Christopher Columbus;* model of a full-rigged sailing vessel and a model of a proposed seagoing canal boat; model of a rectangular passenger vessel and a tank for testing these models.

Mack Engineering & Supply Company, 123 Liberty Street, New York.—Firebrick and furnace linings.

Mallory Industries, Inc., 42 Broadway, New York.—Independent Wireless Telegraph Company, a subsidiary, exhibited a modern ship radio installation including high power and low power sets for long and moderate range communication, high power set with 5-kilowatt arc and 1-kilowatt spark; various other types of radio equipment shown. Crystal division of the Mallory Industries exhibited washing machines.

Marine Canvas Supply Company, Pier 7, North River, New York.—Canvas and rope cargo nets; rope ladders, canvas bags, flags.

Marine Decking & Supply Company, Philadelphia, Pa.—'Lit-O-Sil-O decking, Madesco marine paints (demonstration of painting steel under water), Madesco solution, Madesco tackle blocks, model of section of S. S. *Charles H. Cramp* equipped with Madesco blocks.

Marine Journal, The, 17 State street, New York.

Marine Review, The, Cleveland, Ohio.

Marine Works, Inc., The, 3 Coenties Slip, New York.—Kitchen equipment, cooking utensils.

Maritime Engineering and Sales Corporation—Allan Cunningham Company, Inc., 2 Rector street, New York.—Allan Cunningham 25-40-horsepower electric cargo winch; McTaggart-Scott type hydraulic telemotor; Waterbury hydraulic variable speed gear demonstrating set; Bennett flue blower and combustion chamber cleaner; "Tyfon" air siren.

Masten Company, Inc., J. H., 38 East 9th street, New York.—Life preservers, motors for small boats and small propellers.

Metal & Thermit Corporation, 120 Broadway, New York.—Section of thermit weld made on pin journal of 8½-inch diameter Diesel engine crank shaft; specimens of thermit welded pipe; lantern slides of thermit process applied to various marine welds; demonstration of thermit process to pipe welding; moving pictures of welding process applied to weld in the stern frame of steamship *Northern Pacific.*

Mitchell Ship Salvage Company, Port Jefferson, Long Island.—Photographs and literature.

Munson Steamship Line, 82 Beaver street, New York.—Models of Munson Line ships; painting of the S. S. *American Legion.*

National Hoisting Engine Company, Harrison, N. J.—Five-ton, single drum, single gear, heavy duty, electrically operated ship winch.

National Life Preserver Company, 11 Broadway, New York.—Several dummies with "Everwarm" safety suits.

National Marine League of the U. S. A.—*The National Marine.*

Nautical Gazette, The, New York.

Near East Relief, The, New York.—Literature.

Nelson's Loose-Leaf Encyclopedia.—Several sets of the encyclopedia.

Neptune Association, New York.—Painting of Neptune.

Neptunus Ship Supply Company, Inc., New York.—Erfmann boiler water controller.

New Jersey Asbestos Company, New York.—Semi-metallic packing.

New York Marine News Company, Inc., 26 Water street, New York.—*Marine News.*

New York Maritime Register, 88-90 Gold street, New York.—*Maritime Register.*

New York Engineering Company, 2 Rector street, New York.—Model of Ludlum watertube boiler of 2,250 square feet heating surface equipped with oil burners; Lowy tube cleaners; photographs of installations of Ludlum boilers.

New York State Nautical School, Training Ship *Newport,* New York.—Exhibit of knots and splices.

New York Tribune.—Ship and travel guide.

New York University, New York.—Literature regarding school of commerce, accounts and finance.

Niles, Bement, Pond Company, 111 Broadway, New York.—Gear testing machine; turbine reduction gear; types of spur gears, spiral gears and herringbone gears.

Ocean Marine Engineers' Beneficial Association, No. 80, 15 Whitehall street, New York.

Pacific Mail Steamship Company, San Francisco, Cal.—Model of 535-foot passenger vessel built by New York Shipbuilding Corporation and model of steamship *Ecuador* Background of exhibit in the form of a map illustrating the routes of the Pacific Mail Company. A house flag that has just completed a circuit of the world was also displayed.

Page Steel & Wire Company, New York.—Page ARMCO welding rods and electrodes for oxy-acetylene and electric welding of mild steel plates, structural iron and low carbon castings; water color painting showing application of Page ARMCO welding iron with the oxy-acetylene flame and the electric arc; welded samples demonstrating the toughness and ductility of the finished weld.

Pantasote Company, 11 Broadway, New York.—Full size model of a passenger stateroom furnished with "Vehisote" fiber panel.

Paige & Jones Chemical Company, 15 East 40th street, New York.—F-F-F boiler feed water treatment.

Palmer Bros. Engine Works, Cos Cob, Conn.—Gasoline engines ranging from 2½ to 50 horsepower.

Pioneer Metallic Packing Company, Brooklyn, N. Y.—Metallic packing for reciprocating engines and turbines; hydraulic packing for pump plungers.

Plymouth Cordage Company, North Plymouth, Mass.—Samples of rope and fibers for marine purposes; photographs showing details of manufacturing processes of rope for yacht work; models of the *Resolute* and *Thistle;* moving pictures of rope manufacture.

Pneumercator Company, 15 Park Row, New York.—Models of draft gages, tank gages, etc.

Pyle National Company, 30 Church street, New York.—Small turbo generators.

Quasi Arc Weldtrode Company, Inc., Brooklyn, N. Y.—Torsion testing machine; impact bending weld testing machine; portable D. C. welding outfit; belted welding generator; welding controller; welding booth for actual demonstration; samples of welded ship joints and photograph of electrically welded ship *Fullagar.*

Reid & Company, John, New York.—Sixty-inch ventilation fan operated by a 6¼-inch by 4½-inch forced lubrication enclosed engine; 7½-inch by 5-inch open type forced lubrication blower engine; 8-inch by 6-inch enclosed type forced lubrication blower engine; oil burning furnace front; sectional coal and oil burning furnace front; knockdown section of a sectional coal and oil burning furnace front; portable furnace front with removable sill, and a 7-inch by 6-inch, 110-volt, 12-kilowatt steam auxiliary lighting set.

Roberts Safety Watertube Boiler Company, Red Bank, N. J.—Small size boiler complete; front of standard boiler for seagoing steamships.

Roebling's Sons Company, John A., Trenton, N. J.—Wire, wire rope, rope fittings, safety slings, insulated wire, gas and electric welding wire, new type wire rope block designed for maximum rope wear.

Row & Davis, Engineers, Inc., 91 West street, New York.—Paracoil evaporators, heaters, coolers, feed water heaters.

Sailors' Snug Harbor, Staten Island, N. Y.—Three models of ships made by sailors at the Home; paintings of vessels.

Scovill Manufacturing Company, Waterbury, Conn.—Brass tubing, rods, wire and sheet metal, condenser tubes and brass pipe; samples of shells manufactured for allied governments during the war.

Seamen's Service Center, 21 Coenties Slip, New York (directed by United States Public Health Service in co-operation with the American Red Cross).

Sea Power, Washington, D. C.

Shepard Electric Crane & Hoist Company, Montour Falls, New York.—2½-ton electric cargo winch in operation; 1-ton trolley hoist with sections cut away for inspection.

Shipping Publishing Company, 32 Broadway, New York.—*Shipping.*

Shonberg, I., Inc., New York—Samples of Babbitt and bearing metals.

Simmons-Boardman Publishing Company, New York.—MARINE ENGINEERING, SHIPBUILDING CYCLOPEDIA, scientific books on naval architecture, marine engineering and shipbuilding.

Smith Port Publishing Company, New York.—*Port of New York Annual.*

South Atlantic Ports Association.—Photographs of the southern ports and maps of the South.

Sperry Gyroscope Company, Brooklyn, N. Y.—Gyro compass, electric log, 24-inch Navy standard searchlight of 4,000,000 candlepower, and model of midship portion of vessel mounted on trunnions and fitted with model stabilizer.

Sterno Corporation, New York.—Samples of sterno canned heat and also anti-freeze.

Steward Davit & Equipment Corporation, 17 Battery Place, New York.—Twenty-foot metallic lifeboat rigged on Steward davits connected up with Steward falls controller; line-throwing gun rigged for operation; typical oiltight manholes; releasing gear for collapsible and class 1-A boats.

Stone Corporation, Junius H., 1400 Broadway, New York.—"Rubberstone" mineral rubber deck covering.

Sturrock Furnace Bridge Wall Company (Boston Engineering Company, Inc., Boston, Mass.; W. W. Booth, 74 Cortlandt street, New York; Jenkins & Miller, Inc., Seattle, Wash.).—Section of corrugated furnace with bridge wall in place.

Sturtevant Company, B. F., Boston, Mass.—Forced draft turbo blower, battleship type; forced draft engine blower, merchant type; 10-kilowatt kerosene auxiliary generating set; 10-kilowatt engine driven generating set; motor driven ventilating fan; 1,500 cubic foot marine heater, and portable ventilating set with electric lamp socket connection.

Submarine Boat Corporation, 11 Pine street, New York.—120-horsepower Diesel engine built by the New London Ship & Engine Company, Groton, Conn.; relief map of Port Newark terminal of the Transmarine Corporation and Newark Bay shipyard and surrounding territory; model of standard 5,350-ton deadweight vessel built by Newark Bay shipyard; inter-pole motors and generators made by the Electro-Dynamic Company, Bayonne, N. J.; background painting of marine scenery giving names and field covered by each of the subsidiary companies both operating and manufacturing; photographs and aerograph maps as well as slides and moving pictures of the plants and their operation.

Submarine Signal Corporation, New York.—Standard receiving apparatus, submarine bell, power plant for lightship, oscillator, Forbes log, slides showing development of submarine signalling equipment and installations.

Sun Shipbuilding Company, Chester, Pa.—Photographs of the plant and its products; model of 10,600-ton tanker *Atlantic Sun.*

Superior Engineering Company, New York.—Soot blower.

Texas Company, The, 17 Battery Place, New York.—Petroleum "Texaco" products.

Thorne-Pioneer Company, Inc., 3 Atlantic avenue, Brooklyn, N. Y.—Metallic packings.

Thorsen Company, P. S., 81 Coffey street, Brooklyn, N. Y.—Application of 85 percent magnesia covering to steam boilers and steam pipes, and of hair felt to brine lines; samples of various materials used for insulation.

Tiebout, W. & J., New York.—Marine hardware, turnbuckles, thimbles, air ports, rings, I-bolts, bitts, etc.

Todd Shipyards Corporation, 15 Whitehall street, New York.—Exhibition of the Tietjen & Lang plant included a Diesel engine model and turbine with reduction gears; White fuel oil system, burners and atomizers in operation; model of typical Scotch boiler; complete model of the Tacoma plant and of 7,500-ton deadweight cargo vessel built at this plant; the Tebo Yacht Basin plant exhibited a model of the steamship *Ormes* built for the Donald Steamship Company; the Robins dry dock showed a working model of a vessel in process of dry docking.

Topping Bros., New York.—Marine hardware, hand capstan, searchlight, chain hoists, side lights, locks, jacks, paint brushes, axes, etc.

Traffic Service Corporation, Chicago and Washington.—*The Traffic World.*

United Marine Contracting Corporation, 15 Whitehall street, New York.—Automobile truck carrying electric welding apparatus.

United States Mail Steamship Company, New York.—Large decorated wall panel portraying the scope of the company and several easels with pictures mounted giving views of the company's vessels.

United States Metal Packing Company, Philadelphia, Pa.—Models showing their different kinds of metallic packing.

Uttmark's Nautical Academy, New York.—Plotting charts, text books on navigation, ½-kilowatt Marconi wireless set.

Valentine & Company, 456 Fifth avenue, New York.—Valspar varnish; tests of wood covered with varnish under running hot and cold water, etc.

Van Nostrand Company, D., New York.—Scientific and technical books on marine engineering, shipbuilding, naigation, astronomy, fuel, etc.

Victor Engineering Company.—Ash ejector.

Wager Furnace Brick Wall Company, Singer Building, New York.—Model of a furnace bridge wall.

Wailes, Dove, Hermiston Corporation, New York.—Samples of bituminous coatings.

Wall Rope Company, 48 South street, New York.—Large coil of 15-inch manila rope, coil of 15-inch Coir rope, smaller sizes of manila rope and tarred fittings; moving pictures of the manufacture of walk-laid rope.

Ward, Leonard Electric Company, Mount Vernon, New York.—Switches, cross bars and rheostats.

Waterbury Company, The, 63 Park Row, New York.—Booth turned over to European War Relief Council.

Wheeler, C. H., Mfg. Company, Philadelphia, Pa.—Froude dynamometer; turbine driven condensate pump; large size radojet air pump, inter-condenser air pump; single stage radojet; full size model half section radojet air pump.

Whitlock Cordage Company, 46 South street, New York.—Samples of manila fiber and bolt and yacht rope, large coil of 10-inch bolt rope hawser; book on knots and splices with demonstrating board; new rope schedules for Whitlock products; pictures of rope in various processes of manufacture; large paintaing showing hemp fiber in the stripping process in the Philippines.

Williams, William E., 62 Front street, New York.—Brass, steel and iron body valves of globe and cross types; valves with monel metal trimmings for superheated and high pressure steam.

Williams Valve Company, D. T., Cincinnati, Ohio (Williams & Wells, exclusive distributors, New York).—Bronze valves, oil and grease cups.

Wilson Welder & Metals Company, New York.—Two-arc gas driven portable welding unit; two-arc A. C. portable welding unit, one-arc D. C. portable welding unit; track and bond welder; samples of welds and a welding booth for demonstrating the making of welds by the plastic arc system.

Woodward & Chamberlain, Inc., New York.—Harpoons, fish hooks, rigger's tools, marine signals, turnbuckles, thimbles, oars.

Woolsey Paint & Color Company, C. A., Jersey City, N. J.—Samples of marine paint.

Worthington Pump & Machinery Corporation, 115 Broadway, New York.—Steam air ejector; 4-inch centrifugal turbo circulating pump; duplex packed piston pump for feed and general service; turbo feed pump capable of supplying feed water at 390 pounds pressure for 25,000 horsepower; a cabinet of steam pump models; two water color pictures showing a section and elevation of a motorship installation; a Worthington standard surface condenser mounted on a combined air and circulating pump; Worthington-Blake-Knowles type vertical simplex piston pump; Worthington-Blake-Knowles type vertical duplex piston pump for boiler feed and general pressure service up to 300 pounds; piston oil meter, marine type, 300 pounds pressure; the original direct acting steam pump made by Henry R. Worthington in 1840, the first direct acting steam pump ever built.

Young Men's Christian Association, merchant marine section.

Marine Equipment Manufacturers and Shipbuilders Organize

AT a meeting held Friday afternoon, January 28, at the Biltmore Hotel, New York, representatives of forty-seven shipbuilding companies, manufacturers of marine equipment and dealers in marine supplies formed an association for the following purposes:

To advance the interests of its members; to promote good will between those who buy and those who sell marine equipment and supplies; to promote and supervise exhibits; to co-operate with other associations in the marine field, to the end that their efforts for the advancement of the designing, building and operation of ships shall be most productive.

An important point brought out at this meeting was the importance of holding the annual marine exposition at the same time as the convention of the Society of Naval Architects and Marine Engineers, the National Marine League, the American Steamship Owners' Association, the Atlantic Coast Shipbuilders' Association, the United States Steamship Operators' Association and others. Shipbuilders are intensely interested in the new inventions and developments in their line of work, and it would be to their mutual advantage if their annual meetings were held at the same time as the marine exposition.

The temporary officers of the association are Colonel E. A. Simmons, Simmons-Boardman Publishing Company, Woolworth Building, New York, acting president; K. L. Ames, Jr., American Steel Foundries, Chicago, Ill., acting secretary.

The following companies were represented at the meeting:

American Car and Foundry Company, New York.
American Engineering Company, Philadelphia, Pa.
American Steel Foundries, Chicago, Ill.
Baltimore Dry Docks & Shipbuilding Company, Baltimore, Md.
Bethlehem Shipbuilding Corporation, Bethlehem, Pa.
Brunswick Refrigerating Company, New Brunswick, N. J.
Coen Company, San Francisco, Cal.
Columbian Bronze Corporation, New York.
Columbian Rope Company, Auburn, N. Y.
Charles Cory & Son, Inc., New York.
Crane Company, Chicago, Ill.
Cutler-Hammer Mfg. Co., Milwaukee, Wis.
Electro-Dynamic Company, Bayonne, N. J.
Estate of Adolph Starke, Brooklyn, N. Y.
Fairbanks, Morse & Company, Chicago, Ill.
Federal Bending Machine Company, Bayonne, N. J.
Gold Car Heating & Lighting Company, New York.
Griscom-Russell Company, New York.
Horne Manufacturing Company, Jersey City, N. J.
Hyde Windlass Company, Bath, Me.
International Nickel Company, New York.
Kelley Industrial Corporation, New York.
Locomotive Superheater Company, New York.
Marine Decking & Supply Company, Philadelphia, Pa.
Marine Engineering, New York.
Marine News, New York.
Naval Company, Philadelphia, Pa.
Niles-Bement-Pond Company, New York.
Page Steel and Wire Company, New York .
Paige & Jones Chemical Company, New York.
Pacific Marine Review, San Francisco, Cal.
Pneumercator Company, New York.
Pyle-National Company, Chicago, Ill.
Shepard Electric Crane and Hoist Company, Montour Falls, N. Y.
Steward Davit Equipment Corporation, New York.
Sperry Gyroscope Company, Brooklyn, N. Y.
W. & J. Tiebout, New York.
The Texas Company, New York.
Todd Shipyards Corporation, New York.
Wailes, Dove, Hermiston Corporation, New York.
Wall Rope Works, New York.
Wheeler, C. H., Mfg. Company, Philadelphia, Pa.
Westinghouse Electric & Mfg. Company, East Pittsburgh, Pa.
Williams & Wells Company, New York.
William E. Williams Valve Company, Brooklyn, N. Y.
C. A. Woolsey Paint & Color Company, Jersey City, N. J.

A committee, consisting of G. W. Selby, Marine Decking & Supply Company, chairman; W. H. Easton, Westinghouse Electric & Manufacturing Company; Gardner Cornett, Pneumercator Company; F. O. Cheston, American Car & Foundry Company; W. M. Wampler, Coen Company; K. W. Heinrich, Bethlehem Shipbuilding Corporation; H. B. Oatley, Locomotive Superheater Company; F. C. Bradbury, Crane Company; J. H. Johnson, Baltimore Dry Docks & Shipbuilding Company; J. R. Tiebout, W. & J. Tiebout, and D. C. Spencer, American Engineering Company, was appointed by the acting president to draft a constitution and by-laws. As soon as the report of this committee is ready, another meeting will be held and a permanent organization effected.

The plans of the Marine Equipment Manufacturers' Association provide that unless for some very special reason not now foreseen there shall be but one show a year to be held simultaneously with the annual conventions of such organizations as the Society of Naval Architects and Marine Engineers.

Progress of Shipbuilding in the United States

TABLE I—STEEL TONNAGE BUILDING AND CONTRACTED FOR IN THE UNITED STATES FOR PRIVATE OWNERS SEPARATED BY METHOD OF PROPULSION

COAST	RECIPROCATING				TURBINE				DIESEL				NO POWER				TOTAL			
	Cargo		Tank		Cargo		Tank		Cargo		Tank		Cargo		Tank		Cargo		Tank	
	No.	G.T.	No.	G.T.	No.	G.T.	No.	G.T.	No.	G.T.	No.	G.T	No.	G.T.	No.	G.T.	No.	G.T.	No.	G.T.
Atlantic	45	115,011	69	486,373	12	61,275	2	12,000	4	16,200	6	57,950	25	9,260	26	14,860	86	201,746	103	571,183
Pacific	..	.....	38	276,307	2	19,600	..	.....	1	3,900	2	3,438	..	.....	..	.....	3	22,900	40	279,745
Gulf	2	7,169	2	15,600	8	48,000	..	.....	1	350	..	.....	3	600	15	5,600	14	56,119	17	21,200
Great Lakes	6	11,916	..	.....	..	.....	..	.....	..	.....	..	.....	..	.....	..	.....	6	11,916	..	.....
Interior	2	400	..	.....	..	.....	..	.....	..	.....	..	.....	109	69,975	..	.....	111	70,375	..	.....
	55	134,496	109	778,280	22	128,275	2	12,000	6	20,450	8	61,388	137	79,835	41	20,460	220	363,056	160	872,128

TABLE II—STEEL TONNAGE BUILDING IN THE UNITED STATES FOR THE UNITED STATES SHIPPING BOARD. SEPARATED BY METHOD OF PROPULSION

COAST	RECIPROCATING				TURBINE				DIESEL				NO POWER				TOTAL			
	Cargo		Tank		Cargo		Tank		Cargo		Tank		Cargo		Tank		Cargo		Tank	
	No.	G.T	No.	G.T.	No.	G.T.	No.	G.T.	No.	G.T.	No.	G.T.	No.	G.T.	No.	G.T.	No.	G.T.	No.	G.T
Atlantic	2	10,880	..	.....	4	23,880	5	34,000	1	10,000	..	.....	..	.....	..	.....	7	44,760	5	34,000
Pacific	12	80,006	3	21,000	4	26,000	..	.....	..	.....	..	.....	..	.....	..	.....	16	106,006	3	21,000
Gulf	3	17,952	..	.....	6	40,800	..	.....	..	.....	..	.....	..	.....	..	.....	9	58,752	..	.....
Great Lakes	1	2,677	..	.....	..	.....	..	.....	..	.....	..	.....	..	.....	..	.....	1	2,677	..	.....
Interior	..	.....	..	.....	..	.....	..	.....	..	.....	..	.....	..	.....	..	.....	..	.....	..	.....
	18	111,515	3	21,000	14	90,680	5	34,000	1	10,000	..	.....	..	.....	..	.....	33	212,195	8	55,000
	Transports		Passenger and Cargo		Transports		Passenger and Cargo										Transport		Passenger and Cargo	
Atlantic	..	.....	4	42,000	4	30,220	16	168,000	..	.....	..	.....	..	.....	..	.....	4	30,220	20	210,000
	..	.....	4	42,000	4	30,220	16	168,000	..	.....	..	.....	..	.....	..	.....	4	30,220	20	210,000

TABLE III—TOTAL STEEL TONNAGE BUILDING AND CONTRACTED FOR IN THE UNITED STATES

COAST	RECIPROCATING				TURBINE				DIESEL				NO POWER				TOTAL			
	Cargo		Tank		Cargo		Tank		Cargo		Tank		Cargo		Tank		Cargo		Tank	
	No.	G.T.	No.	G.T.	No.	G.T.	No.	G.T.	No.	G.T.	No.	G.T.	No.	G.T.	No.	G.T.	No.	G.T.	No.	G.T.
Atlantic	47	125,891	69	486,373	16	85,155	7	46,000	5	26,200	6	57,950	25	9,260	26	14,860	93	246,506	108	605,183
Pacific	12	80,006	41	297,307	6	45,000	..	.....	1	3,900	2	3,438	..	.....	..	.....	19	128,906	43	300,745
Gulf	5	25,121	2	15,600	14	88,800	..	.....	1	350	..	.....	3	600	15	5,600	23	114,871	17	21,200
Great Lakes	7	14,593	..	.....	..	.....	..	.....	..	.....	..	.....	..	.....	..	.....	7	14,593	..	.....
Interior	2	400	..	.....	..	.....	..	.....	..	.....	..	.....	109	69,975	..	.....	111	70,375	..	.....
	73	246,011	112	799,280	36	218,955	7	46,000	7	30,450	8	61,388	138	79,835	41	20,460	253	575,251	168	927,128
	Transports		Passenger and Cargo		Transports		Passenger and Cargo										Transports		Passenger and Cargo	
	No.	G.T.	No.	G.T.	No.	G.T.	No.	G.T.	No.	G.T.	No.	G.T.	No.	G.T.	No.	G.T.	No.	G.T.	No.	G.T.
Atlantic	..	.....	4	42,000	4	30,220	16	168,000	..	.....	..	.....	..	.....	..	.....	4	30,220	20	210,000
Total																	257	605,471	188	1,137,128

Statistics compiled by the Bureau of Navigation of the Department of Commerce show that during 1920 American shipbuilders built for American owners 1,758 merchant vessels of 2,831,343 gross tons as compared with 2,338 vessels of 4,213,891 gross tons during the year 1919. In 1920 twenty-five additional vessels of 29,382 gross tons were built for foreign owners as against 25 vessels of 44,250 gross tons built for foreign owners during the previous year. Of the 1920 output, 617 vessels of 2,557,032 gross tons were built of steel.

According to figures published in the January issue of the BULLETIN of the American Bureau of Shipping, from which Tables I to IV are reproduced, there are now building or contracted for in the United States, 445 steel vessels totaling 1,742,599 gross tons. Of these vessels, 380 of 1,235,184 gross tons are building for private owners and 65 vessels of 507,415 gross tons are building for the United States Shipping Board. Of the vessels building for private account, 365,056 gross tons are cargo ships and 872,128 gross tons are tankers. Of the vessels building for the Shipping Board, 212,195 gross tons are cargo ships; 55,000 gross tons are tankers and 210,000 gross tons are passenger and cargo vessels. The total number of motorships under construction is 15, aggregating 91,838 gross tons, all but one of which are for private account.

United States Shipyards Built 1,783 Vessels in 1920

During 1920 1,758 merchant vessels of 2,831,343 gross tons were built in American shipyards, according to the report of the Bureau of Navigation of the Department of Commerce. American shipbuilders also built 25 vessels of 29,382 gross tons for foreign owners, making a total output of 1,783 vessels of 2,860,725 gross tons for the twelve months. During the calendar year 1919 the corresponding output was 2,338 vessels of 4,213,891 gross tons for American and 25 vessels of 44,250 gross tons for foreign owners, a total of 2,363 vessels of 4,258,141 gross tons. Of the 1920 output, 617 vessels of 2,557,032 gross tons were built of steel, a decrease of 299 vessels and 1,012,792 gross tons compared with 1919.

The following details of vessels built and officially numbered in the United States in 1920 are reported by the Bureau of Navigation, Department of Commerce:

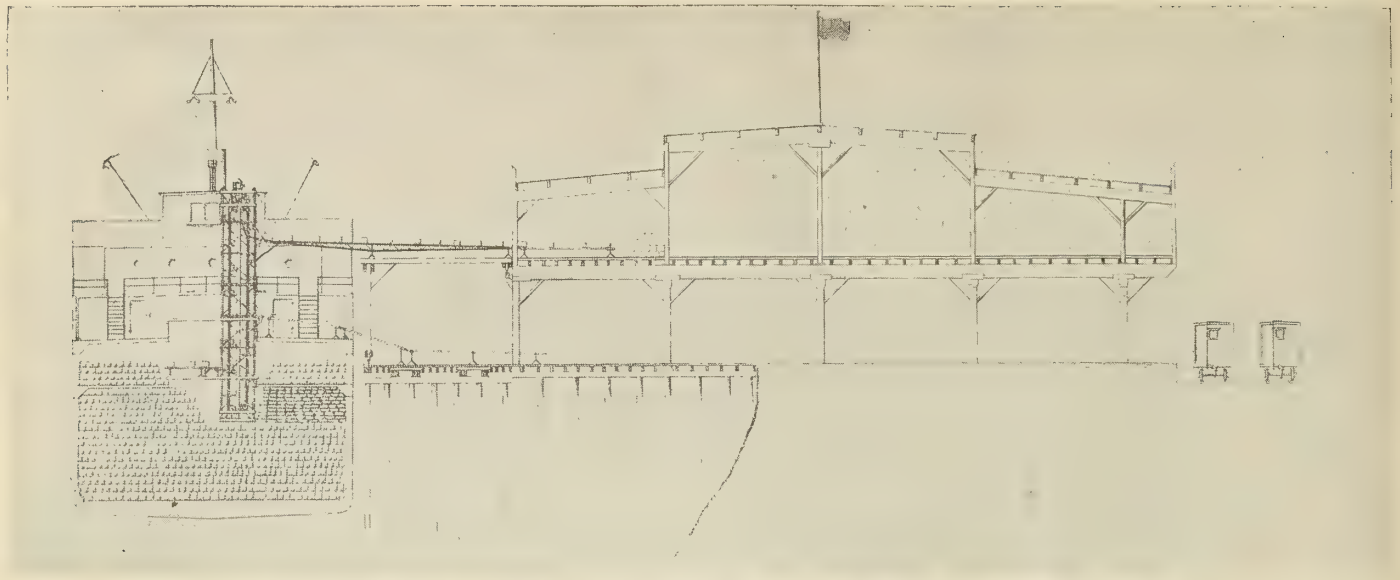
	Atlantic & Gulf		Pacific		Great Lakes		Western Rivers		Total	
Wood	No.	Tons	No.	Tons	No.	Tons	No.	Tons	No.	Tons
Sailing	72	73,629	18	37,067	1	2,051	..	....	91	112,747
Steam	52	12,122	20	39,011	20	1,963	11	1,039	103	54,135
Gas	313	12,049	280	19,003	50	1,019	62	1,024	705	33,095
Unrigged	164	65,816	35	5,626	18	2,274	25	618	242	74,334
Total	601	163,616	353	109,707	89	7,307	98	2,681	1,141	274,311
Metal—										
Sailing	1	1,189	..	....	..	....	..	....	1	1,189
Steam	*337	1,627,744	†120	700,039	67	169,811	4	3,802	528	2,501,396
Gas	14	21,200	6	3,963	1	55	8	156	29	25,274
Unrigged	39	20,459	1	165	‡9	3,271	10	5,278	59	29,173
Total	391	1,670,592	127	704,067	77	173,137	22	9,236	617	2,557,032
Totals—										
Sailing	73	74,818	18	37,067	1	2,051	..	....	92	113,936
Steam	389	1,639,866	140	739,050	87	171,774	15	4,841	631	2,555,531
Gas	327	33,249	286	22,866	51	1,074	70	1,180	734	58,369
Unrigged	203	86,275	36	5,791	27	5,545	35	5,896	301	103,507
Grand total	992	1,834,208	480	804,774	166	180,444	120	11,917	1,758	2,831,343

* Includes 4 vessels of 25,940 gross tons built of reinforced concrete.
† Includes 3 vessels of 19,116 gross tons built of reinforced concrete.
‡ Includes 4 vessels of 1,224 gross tons built of reinforced concrete.

TABLE IV—RANGE IN GROSS TONS, OF ALL STEEL TONNAGE BUILDING IN THE UNITED STATES

TONNAGE RANGE	No.	Gross Tons
Size Range		
under 500	94	32,667
501 to 1000	116	86,041
1001 to 2000	12	17,380
2001 to 3000	8	22,313
3001 to 4000	16	58,213
4001 to 5000	6	27,668
5001 to 6000	38	215,518
6001 to 7000	51	341,063
7001 to 8000	42	312,387
8001 to 9000	23	201,549
9001 to 10000	9	88,600
10001 to 11000	22	231,200
11001 to 12000	..	.....
12001 to 13000	..	.....
13001 to 14000	8	108,000
	445	1,742,599

Of the vessels 1001 Gross Tons and over the average is about 6900 G.



View Showing Elevator Loading at Second Deck, High Tide, Ship With Practically Full Load

Automatic Cargo Handling Proposed

DUE to the wide variety of cargo weights and sizes handled on its piers, the Port of Seattle Commission has constantly sought to facilitate the handling problem.

As a result of this effort a new and practical cargo handling equipment has been designed by George F. Nicholson, chief engineer of the Port of Seattle. This device is largely automatic, power-driven and is especially designed for handling cargoes brought to Seattle in great volume by the United States Shipping Board's fleet of 8,800-ton vessels engaged in the Orient, South American, Atlantic seaboard and European trade. The device is in the shape of an elevator, is placed in a perpendicular position in the hold of a vessel berthed at the pier, and can handle approximately 4,500 pounds of package cargo every minute.

The device is designed as a ship's cargo elevator, and it will be constructed particularly for the new Smith Cove Pier B terminal, a description of which appeared recently in the columns of Marine Engineering. This terminal, the largest in the world, is prepared to handle a big volume of package cargo, and in this handling the new ship's elevator is expected to be a speedy and labor-saving agency.

While designed for Pier B, the ship's cargo elevator may be used in a ship at any pier having a wide apron. It is of steel frame, 43 feet long, the frame being portable in order to allow it to be set aside on the pier when not in use. It has a total weight of 8,000 pounds and may be picked up in two parts, each part weighing 4,000 pounds, by the ship's boom and spotted in the hold of the vessel. When both parts have been spotted in the hold the frame is simply bolted together, the frame standing upright in the hold. This structure, having been installed in the ship's hold, is braced with guy wires from the coning beam to the ship's side. An endless chain revolves in this frame and fastened to this chain are fingered trays five feet apart, each tray having a capacity of 300 pounds.

The cargo is brought to a receiving table by means of gravity rolls. Package cargo is then taken from the receiving table and sent down an incline chute to a stationary receiving tray. The equipment is adjusted so that the fingers of the moving trays pass between the fingers of the stationary tray, thereby catching the cargo on the latter tray and moving it up the frame to the top, where the cargo is discharged by a similar tray automatic trip. Gravity rolls on power conveyors catch the released cargo and the freight is thus taken inside the pier. This power conveyor is set at the same speed as the elevator.

Another feature of this cargo elevator is that it can be operated at the same time the ship's winch is being operated on the heavier freight, thus saving handling and facilitating the unloading of the vessel. The elevator will operate at the rate of 60 feet a minute. It is motor driven, the motor being located at the top and connected by a belt to the driving wheel.

This machine, says Chief Engineer Nicholson, will be of material assistance in handling such package cargo as salmon, pineapples, sugar, flour and similar freight.

Merchant Marine Association Holds Convention

(*Continued from page* 160)

Shipping Board should promise to allocate no steamers for operation in that service.

W. A. Harriman

W. A. Harriman, chairman of the Board of the United American Lines, stated that we were receiving very little benefit from the Merchant Marine Act and that exemption from excess profit taxes would not be much of a factor in the future. He declared that we could not stay a great export nation without the proper development of our merchant marine.

Mr. Harriman quoted some very low figures at which foreign merchant and passenger vessels are being offered and, while doubting the ability of the Shipping Board to dispose of its vessels at any price at the present time, he suggested that the Shipping Board should fix a price on their vessels that would allow the shipowner to compete with foreign owners.

Frank C. Munson

Frank C. Munson, president of the Munson steamship lines, stated that we now have 25,000,000 deadweight tons of shipping under our flag, fifteen million tons of which are in foreign trade, which is ten times as much as we had ten years ago. He said that the Shipping Board exerted a vital influence on shipping, that shipowners were afraid to buy ships now because they did not know what the policy of the Board would be. In regard to fixing prices, he recommended that the Board ascertain what the book values of foreign ships are.

Mr. Munson believes that it would pay the Board to remove the boilers and engines of some of the vessels and install Diesel engines. He favors the bare boat system of chartering because it would force operators to carry on business for

profit or loss. Two dollars to $2.75 per deadweight ton should, in his opinion, be a fair price for the ships and should include both manning and victualing.

Mr. Munson declared that 50 percent of the tonnage now tied up by the Shipping Board could be run if it took competing rates, and that a number of foreign ships were now being used by foreign operators. He believes in co-operation with Great Britain and other nations in the development of the world's trade.

Resolutions Adopted by the National Merchant Marine Association

RESOLVED, By the National Merchant Marine Association that, in order to establish the full practical value of the measure in the development of the new merchant shipping of the United States, we strongly urge the immediate and faithful enforcement of the Merchant Marine Act of 1920.

RESOLVED, That the personnel of the United States Shipping Board be put upon a basis of permanency, in order that a constructive administrative policy may be carried out in the application of the law.

RESOLVED, That private American enterprise must be encouraged to engage in shipping through the means of national aid wherever found necessary by the Shipping Board, to the end that American ships under the American flag may operate in competition with foreign ships in the same trades.

RESOLVED, That in order that the farmers, manufacturers and other producers of this country shall be enabled to compete successfully in foreign markets, and in order that ultimately our merchant marine shall be privately owned by citizens of all sections, we urge that it should be decided what new mail, passenger and cargo routes are to be established and operated by the Shipping Board from our various ports and that arrangements should be made, accordingly for their present and future development, with a view to the purchase of routes and ships as soon as practicable by companies and individuals, selected wherever possible from their respective sections or ports.

RESOLVED, That wherever reasonably adequate services are already being performed by private owned ships or by Government owned ships in the hands of private operators, the Shipping Board be urged to cease to allocate further tonnage to these particular routes, so that the concerns already in these trades may have a fair chance of development.

RESOLVED, That it is evident that the high prices at which Shipping Board vessels have been sold to purchasers are proving an excessive burden on American operating companies in competition with the ships of foreign nations, and that we, therefore, urge that an equitable plan of relief be devised and applied in these cases by the Shipping Board.

RESOLVED, That we heartily approve the present policy of enrolling in the naval reserve competent American officers and men of the merchant marine, and that we recommend that this policy be broadened and made permanent by the Navy Department and by Congress.

RESOLVED, That in the interest of the navy and the merchant marine alike in which so many young men of the Middle West are serving, we urge that the important naval training station on the Great Lakes be not abandoned by the Government.

We deplore pessimism and destructive criticism and we respectfully urge upon Congress and upon the people of the United States a spirit of constructive co-operation, a spirit of optimism, and a firm determination to achieve, in spite of all difficultes, our national purpose of developing and maintaining an American merchant marine for the National defense and for the proper growth of our foreign and domestic commerce.

Passenger Steamer Modasa Launched

THE *Modasa,* a fine twin screw screw passenger steamer of the intermediate type for the British India Steam Navigation Company, Limited, was recently launched from the Neptune yard of the Swan Hunter and Wigham Richardson Company Limited, Newcastle-on-Tyne. The vessel is about 480 feet in length by 58 feet breadth by 36 feet depth. She is being constructed to attain the highest class in Lloyd's Register and the watertight subdivision and arrangements are in accordance with the International Convention requirements.

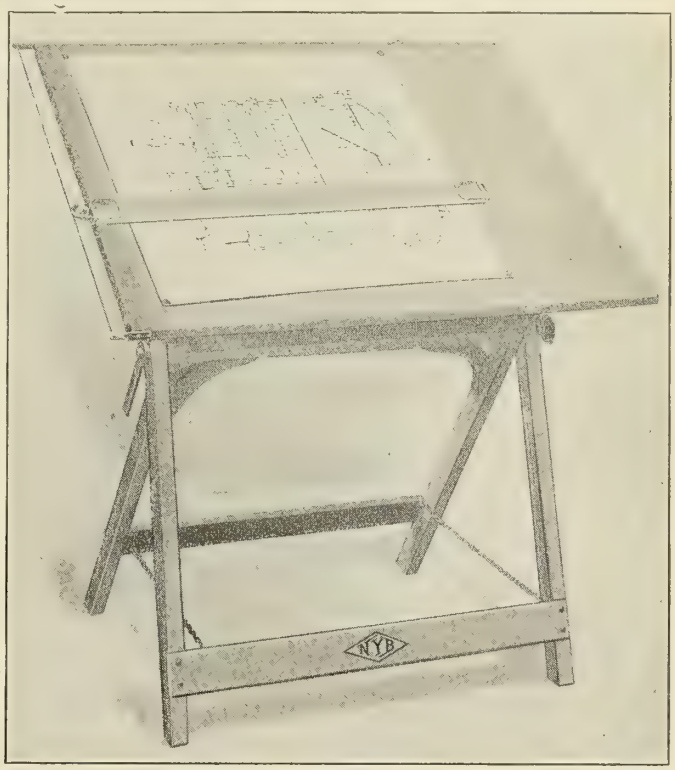
The steamer is expected to carry about 10,750 tons deadweight and will be fitted with accommodation for about 80 first class, 40 second class and 36 extra berths which can be used either for first or second class passengers. Large dining, smoking and music rooms are provided for both classes of passengers, all these public rooms being on the promenade deck, and a special feature of this deck is the large extent of clear deck space for games and recreation.

The main propelling machinery consists of a twin set of double reduction geared turbines of the Metropolitan-Vickers Rateau type, supplied with steam by five large boilers constructed also by Swan, Hunter & Wigham Richardson, Ltd., at their Neptune Works. A sea speed of about 14 knots is anticipated.

The vessel will be well supplied with auxiliary machinery for purposes of navigation and for working the cargo, including 15 steam winches, steam steering gear, etc. The vessel will be lighted electrically, steam heating will be fitted throughout and there is refrigerating machinery for insulated chambers for ship's provisions. There will be an installation of wireless telegraphy, together with an ample supply of boats, etc.

Parallel Ruling Attachment for Drawing Boards

THE New York Blue Print Paper Company, 102 Reade Street, New York, manufacturers of drawing and tracing papers and drafting room equipment, has developed a parallel ruling attachment which may be applied to any drawing board, large or small, with the complete elimination of cords or wires on the surface of the board. Similar cords are also done away with on the under side of the board together with the metal parts which have been necessary to give the straight edge the required accuracy in producing parallel lines.



Precise Parallel Ruling Attachment

The Precise parallel attachment consists of a double pulley plate, a plate with two small pulleys which are fastened at either end of the straight edge and four metal brackets to which the cords are attached and a small grip to hold the cords firmly. The combined weight of the attachment parts is about two ounces.

Correction.—Inadvertently the Jacksonville Ship Outfitting Yard, Jacksonville, Fla., was omitted from the list of repair yards published in the January, 1921, issue of Marine Engineering. This yard has no dry dock but is equipped with a fabricating shop, boiler shop, smith shop, pipe shop, carpenter shop, joiner shop, tin shop, coppersmith shop, plumbing shop, rigging shop and sail loft, electric shop and machine shop and is engaged in general repair work. The yard has 700 feet of waterfront and there is a 50-ton traveling crane with a 125-foot boom to facilitate work such as the removal of machinery.

In the same article it was erroneously stated that the Lord Dry Dock Corporation has a 10,000-ton marine railway at its Weehawken, New Jersey, plant. This plant will be equipped with dry docks of from 1,000 to 10,000 tons lifting capacity, but will have no marine railway.

Marine Engineering

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WE GUARANTEE that of this issue 8,200 copies were printed; that of these 8,200 copies 6,576 were mailed to regular paid subscribers, 360 were provided for counter and news company sales, 325 were mailed to advertisers, 79 were mailed to employees and correspondents, and 860 were provided for new subscriptions, samples, copies lost in the mail and office use; that the total copies printed this year to date were 17,700, an average of 8,850 copies a month.

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Subsidy Versus Government Ownership

IT is immaterial whether the direct cost of our merchant marine is three or four billion dollars. The indirect cost is practically the whole national debt and the loss and maiming of hundreds of thousands of our young men. Germany would never have gone to war with us if we had had a large merchant marine; in fact, if we had as many ships in 1914 as we have now, there probably would not have been any war. We can never again allow our Navy to depend on the merchant vessels of a foreign nation, and if our laws are not such that private owners can operate these ships successfully, the Government must operate them itself.

The consensus of the best opinion in the shipping world is that the merchant marine can be developed for the best interests of the country in the hands of private owners, but if this is to be done we must fix it so that our operators can meet foreign competition on an equal basis. An excellent start has been made with the Merchant Marine Law of 1920. Section 23 provides that the owners of a vessel documented under the laws of the United States and operated in foreign trade shall be exempted from the excess profit taxes provided that this money is invested in new vessels. As the Shipping Board has already approved the applications for about $60,000,000 worth of new construction under the provisions of this section, it is evident that this form of subsidy is proving a success for both the shipping and shipbuilding industries. The construction loan fund (Section 11), which provides that a sum of $25,000,000 may be annually set aside to be used to aid in the construction of the best type of vessels, is not a subsidy, but it is excellent constructive legislation.

Section 28, which provides that preferential rail export rates may be granted only to American vessels, is an indirect subsidy. This section has not yet been put into operation, the excuse being that sufficient American vessels were still unavailable to carry our commerce. In view of the number of government vessels recently tied up, it is hard to see the logic of this explanation, and it would seem that as we have a reserve of ships to draw from that now is the time to try out the provisions of this section.

Another form of indirect subsidy is contained in Section 34, which provides that treaties with foreign powers which prevent the right of the United States to impose discriminatory customs duties on imports entering the United States in foreign vessels and discriminatory tonnage duties on foreign vessels, should be terminated. The present administration has taken no steps to comply with this law in spite of the fact that this is a most critical time in the development of our merchant marine. Our first Congress lost no time in enacting similar discriminatory duties, with the result that our merchant marine was built up to such a degree that we carried 80 percent of our commerce in our own ships. The new administration is confronted with the difficult problem of deciding whether the above-mentioned discriminatory duties or an equivalent direct subsidy will best serve our interests. Among the objections to the impositions of discriminatory duties may be cited the length of time necessary to revise existing treaties, the effect on our foreign relations and the retaliatory legislation that may be enacted by foreign powers. On the other hand, it has been very difficult in the past to interest Congress in direct subsidies, and if direct subsidies cannot be obtained, then the provisions of our treaties that prevent the imposition of discriminatory duties should be abrogated and the law enforced.

Passenger Vessels

"NEW passenger vessels must be built and there is a tremendous construction programme in mind for coastwise services," said Mr. Homer L. Ferguson, president of the Newport News Shipbuilding & Dry Dock Company, in his opening address at the recent meeting of the Society of Naval Architects and Marine Engineers. Almost the entire efforts of the shipbuilding industry during the war were devoted to the construction of ocean-going cargo vessels, with the result that we will be temporarily overstocked with freighters until the world resumes its normal trade. On the other hand, the submarines and natural causes have reduced the number of passenger vessels to such an extent that there is an indefinite prospect of work ahead on this type of ships.

That England is not unaware of the possibilities of liner construction is evident from a paper recently read before one of their technical societies and referred to in a speech at the launching of the Canadian Pacific steamship *Montrose* at the Fairfield yard on the Clyde. It was stated that in 1914 there were 3,100 vessels of the liner type having a total tonnage of 13,350,000 tons and that today there are only 2,470 such vessels, which is 630 less than there were in the prewar days. Sooner or later this tonnage, with the natural increase, which represents a shortage of about 2,000,000 tons, must be made up, and it is only the high cost of construction and labor conditions in England that is holding this work back.

It is known that many American steamship lines are planning the construction of new vessels, taking advantage of Section 23 of the Merchant Marine Act of 1920, which provides that excess profits earned by American ships are exempt from taxation provided they are invested in the construction of new

ships. If our well-equipped shipyards receive the proper co-operation from their employees in regard to this proposed work, there is no question of our ability to produce the best type of ocean liners. We refer those who doubt this to the Nestor of all vessels—the American battleship.

Marine Expositions

MARINE Expositions present a splendid opportunity to the naval architects, marine engineers and all of those connected with the shipping and shipbuilding industry to examine and study the latest developments in equipment, supplies, ships, dry docks, etc. For this reason it is very important that the date at which a marine exposition is held should coincide with as many of the anual meetings of the marine associations and societies as possible.

The very fact that the attendance of a large number of the ship and engine designers who supervise the plans and specifications of everything that goes into a ship could be assured, would influence both the quantity and quality of the exhibits. There is no good reason why the exhibitors, who after all make an exposition possible, should not receive the maximum benefit for the expense and time that they spend on their display.

The expense of these exhibitions is not a small matter, the cost of floor space at the Grand Central Palace, for example, being more than six times the amount paid by the railway people for their annual exhibition at Atlantic City. Can we not have closer co-operation in the future between the various associations in the marine field with a view to not only reducing the cost but also of promoting a closer bond between the buyer and seller of marine equipment?

The Shipping Board

IT is reported that President-elect Harding will name a new Shipping Board immediately after taking office and that the Senate will be called in extra session right after the inaugural ceremonies to confirm his nominations for Cabinet officers and the Shipping Board. The incoming administration and the Republican leaders in Congress have given every indication that they consider the welfare of our merchant marine of the utmost importance, and it is believed that President-elect Harding will give a great deal of his personal attention to our shipping policies.

It is hoped that the above report is true and that the new administration will consider it one of its first and most important duties to appoint a board composed, for the most part, of practical marine men who have established their fitness for the work and who have the confidence and respect of the shipping and shipbuilding industries. It is not easy to find able men who are available for this work and who are willing to make personal sacrifices in order to help build up a great American merchant marine, but now that the election is over and the whole-hearted support of the administration is assured it should be much easier than heretofore to obtain a capable and efficient Shipping Board.

Too much credit cannot be given to Admiral W. S. Benson and Mr. J. A. Donald for their splendid service on the present board, as they have kept courageously and fearlessly at their stupendous task in spite of the investigation and acrimonious criticism that has been almost continually directed at the Shipping Board. Let us hope that the new board will be made up of men of their character, ability and knowledge of the shipping game.

Again the Metric System

REPRESENTATIVE FRED A. BRITTEN, of Illinois, backed by the World Trade Club of San Francisco, introduces a bill for the general use of the metric system after ten years in commercial transactions. The manufacturer is to be allowed to use any weight or measure in production. Representative Britten states that only the lack of consolidation of interests advocating complete adoption of the metric system accounts for previous failures; now the metric forces make an impressive front. There may be an impressive front, but this is a flank attack appropriatively camouflaged, and with delayed action. If it were certain that such an act would clear the field for ten years it would be good politics to let the act through; the manufacturer would continue to manufacture and the traders to trade, and the good old English system would enormously strengthen its hold on industry. The opinion has been expressed in this magazine that the English system cannot be dislodged; ten years will not make that easier.

Labor-Saving Tools in England

THE trades unions in England are doing all they can to stop the use of labor-saving devices. As a result of this mistaken policy on the part of labor a great deal of work that would ordinarily have gone to British shipyards has been diverted to the Continent. For example, an oil tanker which recently struck the rocks in the Channel, damaging her bottom very seriously, was placed in an English dock for repairs. A contract was made to put a new bottom on the ship for £60,000, but the workmen refused to use labor-saving tools and appliances on the work and the repair yard was compelled to approach the owners and point out that, owing to the unexpected refusal of the men to use labor-saving tools, it would be necessary to increase the price by about £7,000. The owners refused to accept the additional cost and the bottom was therefore patched up and the ship taken to Rotterdam.

Information has been received from one firm that the workmen have recently decided not to use labor-saving tools in their shipyard. The firm insisted on their use, but the men stated that they would take every opportunity to damage them, and the result became so serious that tools were returned to the shop badly damaged after being in use for only an hour. In some cases the damages have cost over £5 to repair, and as it is quite obvious that no firm can continue to use tools that require £5 an hour for maintenance, all portable tools have been withdrawn from service in this particular yard. In some yards on the south coast and the English Channel all pneumatic tools have been put out of service by the men. The executive of the boiler maker's union in Cardiff recently stated that no more labor-saving tools were to be used by members of the unions for the time being.

The United States owes a great deal to labor-saving devices and machines for its rapid development. Such tools in-

crease production, and it is largely through their use that the present standard of living has been obtained. Sooner or later the use of labor-saving tools makes it possible to employ more men because they open up projects that could not otherwise be undertaken. The amount of work to be done will surely keep increasing until the multitudes of Asia and Africa have raised their standard of living to somewhere near our own, and the workmen who object to the most expeditious methods of production are not only delaying progress, but they are also injuring themselves and their country.

The Standards

IN a certain vault at the Bureau of Standards there are three platinum kilograms, one in the middle standing a little higher than the others. There are three platinum meters, two in sight and the other sealed in a lacquered tube where it has been ever since Roosevelt put it there. The two side kilograms are for use on occasion, the middle one can be seen but is never touched; in like manner there are two meters for use, the absolute standard cannot even be seen.

In an adjoining room are the balances for comparing standard weights. Each balance is in its own glass case and there are mechanisms for shifting weights without opening the cases. The observer stands off and views the balance through a telescope. When weighings are made the door to this room is shut so that stray drafts of cold air shall not trouble. A 50-pound weight is a sizable chunk of brass, and a thousandth of a milligram is a fleck that can be seen only in a good light; that gives the degree of precision.

On these standards depends the interchangeability which is the basis of the American industrial system. Few people know where the vault is and fewer have entered therein. There is but one key to the inner door, and when the Director of the Bureau wants to go in he sends for the man who carries that key.

The Sinews of War

IT used to be said that money was the sinews of war and a prudent government kept a war chest or the equivalent. We have recently learned that there are times when money will not always buy the munitions of war. The term munitions can be enlarged to mean all the requisites, for example freighters; the history of Hog Island and the wonders accomplished there show that money alone is insufficient, though expended lavishly.

Narrowing our field, let us notice the discussion in the Senate of the two materials, oil and nitrogen. Speakers have called attention to the scramble for oil by the European nations, all of them debtors to the United States and supplicating further extension of credit. There is little disposition to blame those nations, but the plight of the United States is pointed out; we are handicapped in the competition for foreign oil, while our own supply is insufficient and there is no way of protecting it.

It is notorious that the Mussels Shoals nitrogen plant cost $87,000,000—lavishly expended because money will not buy time. Now $12,500,000 are asked to complete the construction of the plant. Fortunately, the plant can be used in peace to make fertilizers and perhaps may pay running expenses; maybe government bookkeepers can show a profit some time. But that is not the question; we should have a sufficient means of making the nitrates needed for modern warfare.

It used to be said that it took a ton of iron to kill a man; the modern rate has not been given out, nor the weight of the powder to drive it.

The Present Status of Naval Engineers

THOUGH there is no corps of engineers in the navy there are naval engineers, or shall it be said that there are officers in command of the engine room? And yet there is not complete satisfaction with the present condition as evidenced by the following quotations from a discussion in the *Journal of the Naval Institute*: "The average engineer enjoys the title of his office because he has been so detailed.....he realizes that he must not be too closely identified with engineering duty for too great a length of time," etc. This must not be taken as representing general opinion in the navy and it is unfair to draw conclusions from fragmentary quotations, but there remains the question whether the present status of naval engineers is satisfactory. It should be remembered that the amalgamation of the staff and the line came about because of friction between the branches of the service and there are those who question the wisdom of that move. Now is a good time to take account of stock and see whether present conditions are satisfactory and whether changes should be made.

The Air Service

THERE is a disposition to unite the air service of the army and navy and form a new department co-ordinate with the war and navy departments, thus avoiding duplication of efforts. Such action should be taken only after mature deliberation, if at all. There are various reasons why the navy desires to keep control of its own service; some of these are administrative and some are due to the nature of the service over the sea.

Though there have been trials of methods for launching an airplane from a ship and for return to the deck of a specially constructed ship, seaplanes normally rise from the water and return to the water and are provided with pontoons for those purposes. The construction of seaplanes is different from the army planes and they are maneuvered in a different manner; a pilot may learn to fly various types of planes, but the best results are had by limiting a man to one class. All persons serving at sea must get the sea habit; not all persons can get the habit; if a flyer is so far affected that he feels uneasy and not quite fit, he is in no condition for his exacting duties.

Perhaps the administrative reasons are the most inexorable. The history of warfare is strewn with failures of combined expeditions of the army and navy. Leaving aside failures due to jealousy and to uncertainty of responsibility, there remain the difficulties of proper co-ordination and understanding; the two services do not speak the same language, although, unfortunately, they think they do.

Our navy has always carried marines, soldiers and sailors too. They always will form an arm of the navy and the seaplanes and dirigibles working with the navy should always belong to the navy and be imbued with the naval spirit.

LETTERS TO THE EDITOR

Diesel Electric Drive for Low Powered Cargo Vessels

In the December, 1920, issue of MARINE ENGINEERING there is an article by Commander S. M. Robinson, U. S. N., entitled "Diesel Electric Drive for Double Ended Ferry Boats and Low Powered Cargo Vessels." In the case of low powered cargo vessels of about 10 knots requiring about 1,500 shaft horsepower the author draws the conclusions that the use of Diesel electric propulsion instead of direct connected Diesel propulsion shows up remarkably well.

I venture to dispute Commander Robinson's argument, particularly as he has based his comparison on an assumption that twin screws would be required for a direct connected installation, and that a single screw can be used for the Diesel electric drive. If this assumption is made on the grounds of reliability it would hardly seem justified, since there are Diesel engines with such consistently good records of performance that a single screw, six cylinder installation of the power required for this vessel should be considered well within the bounds of good practice. Such an installation should certainly be considered as reliable as a single electric motor.

If it is a question of propeller efficiency, there are no Diesel engines except the opposed piston type that can be considered for speeds much below 110 revolutions per minute, but it is also true that an electric motor for a speed as low as 81 revolutions per minute would be unduly large and heavy, and correspondingly costly. The propeller of greatest efficiency, as Commander Robinson has demonstrated, will be one operating at 81 revolutions per minute, but the difference in efficiency between that and one operating at 110 revolutions per minute should not justify going to twin screws and losing thereby 13.2 percent in propulsive efficiency, as Commander Robinson has also demonstrated

Using the hull data given, the tabulation in Table I will indicate the essential differences between the propeller given by Commander Robinson and a propeller which will fulfill the conditions demanded by direct Diesel drive.

These are both three-bladed wheels, but the comparison holds for four-bladed wheels which are more desirable for vessels of this type. It is not the intention of the writer to put forward the claim that propeller No. 2 is as good a wheel as propeller No. 1, but it is almost always necessary to compromise between the most desirable wheel and the size and weight and revolutions of machinery installed to drive it.

The difference in propulsive coefficient in the two screws given above is .8 percent. The electric conversion losses as given by Commander Robinson will not be less than 13 percent. Consequently when the two systems of propulsion are compared on the same basis, i. e., with single screw for each, the difference in efficiency is approximately 12 percent in favor of the direct connected engines.

The writer had occasion recently to investigate this problem for a proposed vessel of 6,500 tons deadweight. For electric drive the cost of propelling machinery only, with exciters and controllers, comes to $185 per shaft horsepower and the weights 472 pounds per shaft horsepower. For direct connected Diesel engine of the same type and make as those figured on for the electric proposition, and including two auxiliary generators direct connected to Diesel engines for operating the auxiliary machinery, the cost amounts to $156.40 per shaft horsepower and the weights 413 pounds per shaft horsepower. There is, therefore, in this instance a saving in favor of direct connected engine of $28.60 per shaft horsepower in the cost of the machinery installation and of 59 pounds per shaft horsepower in the weights. The electrically driven ship would require 13 percent to 15 percent more engine power than the other, with a proportionately greater fuel consumption. The auxiliary machinery is not included in the above, as it is practically the same for both cases. The direct connected Diesel drive was figured for 105 revolutions per minute and the electric motor drive for 125 revolutions per minute. The revolutions for electric drive were not brought down on account of the extremely large size of the motor.

There is no question that the electric drive is the more flexible of the two and has superior maneuvering qualities, but for ordinary slow speed cargo vessels the modern Diesel engine possesses these qualities to a sufficient degree.

WM. MULHERON, Assistant Chief Engineer.
Chester, Pa. Merchant Shipbuilding Corporation.

TABLE I.

	Propeller No. 1	Propeller No. 2
	Single Screw as Designed by Commander Robinson for Electric Drive	Single Screw Suggested for Direct Diesel Drive
$L.W.L.$	324	324
B	47	47
H	21	21
$\frac{B}{L.W.L.}$	.145	.145
$N.B.C.$	.76	.76
K	1.23	1.23
$S.B.C.$	.817	.817
$\frac{2L.A.B.}{H}$	10.3	10.3
S	.21	.21
v	10	10
$e.h.p.$	910	910
$\frac{e.h.p.}{E.H.P.}$	.305	.4
$\frac{v}{V}$	.729	.84
$\frac{et}{E.T.}$	.415	.475
V	13.71	11.9
$E.H.P.$	2,980	2,275
D	16	14.25
$\frac{P.A.}{D.A.}$	.25	.265
$T.S.$	6,000	6,230
$P.C.$	.703	.695
$I.T.D$	2.75	3.1
$I.H.P.d$	1,517	1,550
P	14.75	10.75
s	.1506	.142
Ra	81	110

FRENCH TANKERS.—The Review of the American Chamber of Commerce in France, states that the number of French tank vessels now in service is 9, aggregating 51,270 tons deadweight. Twenty-eight more aggregating 27,250 tons, are being built.

NEW BOOKS

Design of Warships

REVIEWED BY C. H. PEABODY, DR. ENG.

General Design of Warships. By William Hovgaard, professor of naval design and construction, Massachusetts Institute of Technology. Size, 7½ by 10 inches. Pages, 310. Illustrations, 64. Tables, 18. Plates, 10. New York and London, 1920: E. & I. N. Spon, London, and Spon & Chamberlain, New York.

This work completes a series of three text-books by the author covering the part of the curriculum which is given by him at the Massachusetts Institute of Technology to officers designated for the corps of naval constructors, and representing nearly twenty years spent by the author in developing his subject. The other two books are *Modern History of Warships,* recently reviewed in this magazine, and *Structural Design of Warships,* which was published five years ago, but which logically is the work which completes the series. Taken together, these text-books are a notable contribution to the literature of naval architecture, especially as applied to the military side of the profession.

After a preliminary discussion of the principles, limitations and compromise of warship design, the author discusses the limitations of size of warships, with the conclusion that there is as yet no other limitation than expense and typographical conditions such as harbors and docks; the latter may almost be included in the former, since with the expenditure of time and money such restrictions may be modified, if not removed. The conclusion that may be drawn from this discussion and from the author's other works is that the control of the sea depends on capital ships which must be of large, if not of the largest, size; this is a matter of vital interest to our country at this time.

The preliminary determination of the displacement of a ship is made by two methods: (1) by percentage, (2) by the development of a weight equation. The first assumes that the weight of a new ship will have the same distribution as a ship or ships already built and for which the weights are known. Knowing the weight of the armament of a new ship and all the percentages a single proportion gives all the weights. If the new ship differs essentially, that difference is applied to the old ship, its percentages are corrected and then are used as before. This method calls for extensive computation and tabulation extending over a series of years, but it can be applied with celerity and a fair degree of certainty. The second method was first proposed by Normand in 1901, but is here presented in a modified form. A general equation of weights is developed with variables each having its proper exponents. The equation is then differentiated and is used as an equation of finite differences by which increments of displacement of 25 percent can be dealt with, avoiding errors of more than 2 percent. Having the displacement, the principal dimensions, length, beam, draft and freeboard can be assigned by comparison with the type ship or ships on which the design is based.

With the preliminary design in hand the naval architect is in condition to make a detailed study of his problem and to consider the influence of each of the main dimensions and the effect of modifications of them. Thus the length obtained by the preliminary solution is liable to be inconvenient for various reasons; in fact, it may be said that the next step is to consider whether the length cannot be reduced without unduly compromising the design. The designer must make a careful study of the influence of length on speed, and particularly the interrelation of the speed and length of his special problem to avoid critical conditions due to wave formations and their interferences. Sometimes a minor change in the proportions of the ship will lead to a good solution of the problem. All such changes must be made with a view to the effect of changes of beam and draft on power and speed. We have spoken of the main dimensions as though they directly determined the relation of power and speed; in part they do, but the indirect influence through the determination of the shape of the hull may be even more important. The influence of shape is subtle, varying with both absolute size and speed and with the relation of speed and size. This problem is best studied in the light of model experiments and may call for special tests of relative models for the problem in hand.

Of equal importance is the determination of the probable stability of the ship under design and of the relation of the natural periods of rolling and pitching to the periods of the waves which the ship is likely to meet, both their natural periods and the relative periods as affected by the course and speed of the ship. The choice of metacentric height is complicated by the fact that the ship should have proper stability both when intact and when subject to injuries from gun fire, torpedoes and mines, without being so stiff that it cannot provide a steady platform for the ordinance. The author finds that a simplified theoretical discussion of stability can be made to yield results that will almost always guarantee a proper condition and range of stability for the design. In general, the designer can have a fair control of transverse stability, even if he must accept a compromise; but longitudinal stability and its effect on pitching cannot be so well controlled and the designer can at best only avoid undesirable extremes. Ships may be divided into two classes—those that are 500 feet long or more, such as battleships and large cruisers, and those that are shorter, such as small cruisers and destroyers. Large ships are longer than the waves that they are likely to meet, and when they meet very long waves these have only small relative heights; such ships seldom pitch badly. Small ships are liable to pitch excessively under some conditions.

Having the dimensions and proportions of the ship determined, the designer proceeds to lay down the lines and make an original determination of the displacement and other properties, including strength. The author explains and recommends Admiral D. W. Taylor's mathematical method of drawing lines, a method devised in the first place for laying out groups of models for the experimental basin, and which ensured that models should form a true series and all be fair.

The weight schedule is now to be revised and computed in detail both to ensure the success of the design and to furnish a basis for future designs. Along with this there is made the proper trim diagrams and the computations for strength. For this work the integraph is invaluable. It is rather curious that even in the United States mechanical integrators have found favor only in recent times; there seems to have been a feeling among shipbuilders that any method so easy and rapid as ship computation by aid of integrators must be essentially untrustworthy.

Having dealt with the general design of ships, the author takes up the extremely important problem of bilging, now more than ever important in the days of the mine and torpedo. For this purpose the author uses a method that he calls the lost buoyancy method. The fundamental idea has long been known and used, since the readiest and best way of dealing with a ship which has large compartments broken open is to consider that it is a new ship lacking those compartments. The author, however, extends the principle to include all water admitted from the sea in consequence of injury or large leakage and develops a semi-logical method of computation which under proper control can be made to give results that are true and sufficiently accurate; the accuracy is probably at least as good as our knowledge of conditions. In this chapter the author shows up the pernicious effect of longitudinal bulkheads and attributes the sudden loss of the *Lusitania* and the *Empress of Ireland* to the existence of such

(*Continued on page* 174)

Questions and Answers for Marine Engineers

Inquiries of General Interest Regarding Marine Engineering and Shipbuilding Will Be Answered in this Department

CONDUCTED BY JAMES L. BATES

This department is maintained for the service of practical marine engineers, draftsmen and shipbuilders. All inquiries should bear the name and address of the writer. Anonymous communications will not be considered. The identity of the writer, however, will not be disclosed unless the editor is given permission to do so.

Corrosion of Dissimilar Metals Under Water

Q. (1112).—What action takes place on a cast-iron propeller in salt water, when a wooden vessel is fitted with bronze rudder pintles, gudgeons, plates, etc.? Is it best to install all underwater work in iron to get away from the galvanic action between iron, bronze and salt water? Has practice shown that bronze fittings corrode the iron wheel more than when iron fittings are installed? C. R. W.

A. (1112).—When dissimilar metals in direct contact or in close proximity are immersed in sea water, corrosion of the more electro-positive metal due to galvanic action usually results, while the more electro-negative one will be protected. Such action is essentially the same as that which takes place in the voltaic cell where iron and copper are placed in a weak acid with the resultant rapid corrosion of the former metal. The iron or corroding metal is termed electro-positive and the copper electro-negative. Copper, lead, tin and brass alloys are all electro-negative to iron.

The following list of metals as given on page 30, "The Corrosion and Preservation of Iron and Steel," by Cushman and Gardner, is arranged in the order of their diminishing solution tensions:

Magnesium	Nickel
Zinc	Lead
Aluminum	Copper
Cadmium	Tin
Iron	Antimony

A metal at any point in this series is electro-negative to those preceding and electro-positive to those following it.

As to the extent of damage to vessels due to galvanic action, data are somewhat conflicting. Experiment and experience have shown widely divergent results, due possibly to causes mentioned later.

On page 151 of *The Shipbuilding and Shipping Record* of February 17, 1916, is described the remarkable instance of the schooner yacht *Sea Call,* which sustained such serious damage due to galvanic action that she was dismantled and scrapped within three months after launching. The characteristic features responsible for this corrosion were a forged steel stem, cast steel sternpost, and rudder framing, bronze propeller, tinned, and chrome vanadium steel bulb angle framing with monel metal plating except the two upper strakes, which were steel. The rudder was also covered with monel metal plates. Monel metal rivets were used in the plating, except in a few instances where by mistake steel rivets were used. The failure or total disappearance of one of these rivets led to the discovery of the serious damage from corrosion. It was found that severe corrosion had taken place on the forged steel stem, cast steel rudder and stern frames, and the steel bulb angle framing. The monel metal was not affected in any way.

United States naval practice formerly required the fitting of zinc plates on rudder, sternpost, shaft struts and shaft tubes, and zinc rings around composition sea chest openings. The zinc rings have been superseded by medium steel rings and doubling plates, which serve to provide an excess amount of electro-positive material which can be readily removed when corroded. The use of zinc plates on rudder, sternpost, etc., has been abandoned generally, since experiment has shown no injurious effect due to their omission.

As between naval practice and the case of the *Sea Call* there is, admittedly, a wide range. In the former the exposed area of the monel metal was very large compared with the steel, while in the latter the exposed area of steel is overwhelmingly in excess of that of brass alloys. Also the fact that in naval practice the underwater portion of vessels is covered with an anti-corrosive paint containing a large percentage of zinc oxide may prove a contributing factor to the preservation of the steel from corrosion.

In view of the foregoing it is not improbable that the relative areas of exposed surfaces of the dissimilar metals is the principal factor governing galvanic action. This view seems to be supported by Sir William White in his "Manual of Naval Architecture," pages 433 and 434 of the 1900 edition. Further, temperature and salinity of the water also influence corrosion and it sometimes occurs between different portions of the same metal due to lack of homogeneity of the material.

In the case of a wooden vessel under the conditions named, and especially if the outer propeller shaft bearing is or has an exposed bronze bushing, corrosion of the propeller will in all probability result. The extent to which, and the rapidity with which, this would take place is problematical, being influenced by certain of the factors enumerated above as well as by others, such as the quality of the cast iron in the propeller itself.

Underwater work is frequently installed in cast iron, even to the tail shaft bearing and rudder gudgeons. For coastal work where the navigation of muddy rivers is necessary and sand likely to enter the bearings, cast iron bushings are considered good practice, having longer life than lignum vitae staving. Such an installation would, of course, obviate galvanic action.

Practice has demonstrated that the iron wheel will suffer more from corrosion when in the presence of bronze than iron fittings.

Design Curves for Open Motorboat

Q. (1116).—I would like to know if you can give me an example, showing how much should be added to wave form curves for waterline and curve of areas for an open motorboat of the following dimensions:

Length overall	25 feet
Length on waterline	22 feet 6 inches
Beam	7 feet
Draft, to rabbet	1.25 feet
Speed, per hour	9 miles
Midship section area	4.7
Coefficient	0.61
Load waterline area	94 square feet
Load waterline breadth	6.15
Load waterline coefficient	0.68
Prismatic coefficient	0.68
Block coefficient	0.66
Keel, sided, 2¾ inches, molded	6 inches

How could I obtain tables of area curve factors? J. S.

A. (1116).—From the information furnished, the displacement, without appendages, is:

$$\frac{22.5 \times 6.15 \times 1.25 \times .414}{35} = 2.05 \text{ tons, in salt water.}$$

The speed, 9 miles (nautical miles assumed), gives for the

length suggested a value for the speed length ratio of 1.9. For this value the prismatic coefficient .68 suggested is permissible.

In determining the shapes of the curves of sectional areas and load waterline, several methods are available. Each has for its object the securing of a fair, easily driven form, and in order to accomplish this result the load waterline adopted must be suited to the curve of sectional areas. An improper relation between the two will usually result in difficulty in fairing the ends of the underbody.

Should you be interested in making a careful study of underbody forms from a mathematical standpoint, Admiral Taylor's method as described by him in a paper entitled "Calculations for Ships' Forms and the Light Thrown by Model Experiments upon Resistance, Propulsion and Rolling of Ships," presented at a meeting of the International Engineering Congress, 1915, in San Francisco, is of interest. This method is of especial value as illustrating the interdependence of the various elements of form upon each other and as providing a logical means of determining the effect upon all the other elements of the variation in the value of any one. For the development, however, of an individual body plan, the method is somewhat complicated and requires careful study and considerable experience in order to make its use with facility possible.

The method often followed by the writer consists in the reading off of functions for areas of section and load waterline offsets, based upon the area of midship section and load waterline beam, respectively, as unity, from carefully prepared standards. The proper point on the standards at which to read the functions is dependent upon the value of the prismatic coefficient.

For the standard referred to, see pages 187 to 190, inclusive, of *Shipbuilding Cyclopedia,* 1920 edition. Functions are obtained by extrapolation.

	Sectional		Load Waterline	
Station Number	Function	Area	Function	Breadth
0	0	0	0	0
1	.176	.83	.189	1.16
2	.349	1.64	.363	2.24
3	.514	2.42	.523	3.22
4	.661	3.11	.662	4.07
5	.787	3.70	.782	4.87
6	.884	4.15	.878	5.40
7	.947	4.45	.940	5.78
8	.978	4.60	.980	6.02
9	.997	4.68	.996	6.12
10	1.000	4.70	1.000	6.15
11	.996	4.68	1.008	6.20
12	.980	4.61	1.003	6.17
13	.947	4.45	.996	6.12
14	.888	4.17	.985	6.06
15	.788	3.70	.966	5.94
16	.655	3.08	.926	5.69
17	.491	2.31	.864	5.31
18	.329	1.55	.774	4.76
19	.190	.89	.659	4.05
20	.077	.36	.511	3.14

The displacement resulting is:

$$63.9 \times \frac{22.5}{20} \times \frac{1}{35} = 2.05 \text{ tons (by the trapezoidal rule).}$$

It will be noted that the block coefficient used in the first part of the discussion, viz., .414, is not that given among your data. Obviously it is impossible to have for the same boat values of .66, .68 and .61 for block, prismatic and midship section coefficients, respectively. This is because midship section coefficient × prismatic coefficient = block coefficient. Inasmuch as .66 is a rather large value for the block coefficient in a boat of the type under discussion, and because .68 is a reasonable value for the prismatic coefficient of such a boat, the latter has been adopted and a value of .414 for the former has been derived by the use of .68 × .61 for prismatic and midship section coefficients, respectively.

You will note also that the waterline coefficient works out to a value of .787. This is larger than that suggested.

In a similar manner to the above the sectional area and load waterline curves of a boat of known characteristics may be used as standards.

As an example of this method the following figures are given. They are based upon a boat which, while somewhat larger than that which you contemplate, is of good design and has given satisfactory results in the model basin.

	Sectional		Load Waterline	
Station Number	Function	Area	Function	Breadth
0	0	0	0	0
1	.110	.52	.133	.82
2	.258	1.21	.271	1.67
3	.415	1.96	.402	2.48
4	.569	2.68	.531	3.27
5	.698	3.28	.647	3.98
6	.808	3.80	.755	4.64
7	.894	4.20	.843	5.18
8	.953	4.48	.912	5.61
9	.988	4.64	.963	5.92
10	1.000	4.70	1.000	6.15
11	.993	4.67	1.018	6.26
12	.961	4.52	1.022	6.28
13	.903	4.24	1.010	6.21
14	.827	3.89	1.000	6.15
15	.743	3.49	.977	6.01
16	.648	3.05	.943	5.80
17	.549	2.58	.902	5.55
18	.454	2.14	.859	5.28
19	.360	1.70	.804	4.94
20	.270	1.22	.759	4.66

The displacement upon this basis would be about 2.01 tons, and the prismatic and load water plane coefficients, respectively, .663 and .768. This would, in the opinion of the writer, give you satisfactory results.

The above figures are based upon the assumption that a displacement of about two tons will be satisfactory. Should you desire to use a different displacement, it is suggested that the change be made in the draft and the midship section coefficient so as to permit the use of the values of the longitudinal and load water plane coefficients suggested above. The data for the curves of sectional area and load water plane shown above will then be applicable.

Design of Warships

(*Continued from page* 172)

bulkheads. This influence has long been known and was proclaimed time and again long before either ship was built.

The author, who has been a life-long student of the problems of submarines, gives a chapter on the buoyancy and stability of submarines by his constant displacement method, which gives certainty and simplicity to a discussion that is much more difficult than the corresponding discussion of surface ships.

During the war the author was a special expert to the Bureau of Construction and Repair of the United States Navy Department, and in his chapter on troop ships he gives the results of his study of the design of such transports and also of the adaptation of passenger ships to the same service. This latter matter has its own difficulties because passenger ships are purposely made tender so that they may be comfortable. Intact, they are safe in all weathers, but for troopers they must be able to meet some of the exigencies of warfare.

The license, which had to be obtained by every French vessel of over 100 tons gross prior to each voyage and by allied and neutral vessels trading with France and her colonies has been suppressed by a decree published on January 8.

PERSONAL MENTION

John A. Donald, dean of the Shipping Board commissioners, is spending a month's vacation in the Bahamas, with his wife and son.

Edward M. Hyzer, formerly general counsel of the Chicago & Northwestern Railroad, and more recently assistant general counsel for the United States Shipping Board Emergency Fleet Corporation, has been appointed general counsel for the United States Shipping Board vice Colonel Guy D. Goff, recently appointed as a member of the Shipping Board.

Harry Brown, formerly technical manager of the Bethlehem Shipbuilding Corporation, Ltd., Bethlehem, Pa., has been appointed manager of engineering and sales by the directors of the company. H. G. Smith, formerly manager of engineering, was elected assistant to the president, and W. F. Hartmann will succeed E. B. Hill as treasurer.

E. B. Hill, formerly treasurer of the Bethlehem Steel Company, Bethlehem, Pa., and of the Bethlehem Shipbuilding Corporation, Ltd., has been made vice-president of the latter and will be in charge of operations at the Fore River Works, Quincy, Mass. Mr. Hill succeeds J. W. Powell, who is to take up special work for the corporation.

Rear Admiral Albert P. Niblack, U. S. N., serving as naval attaché at London, has been appointed commander-in-chief of the American naval forces in European waters. This appointment carries with it promotion to vice-admiral. Admiral Niblack succeeds Vice-Admiral Harry McL. P. Huse, who has been in command of the United States forces in European waters for the last year. Admiral Niblack graduated from the Naval Academy at Annapolis in 1880, afterwards serving on the Pacific station and in exploration and surveying parties into Alaska for several years. In 1893, he was attached to the Atlantic squadron. From then until the Spanish war he served as naval attaché at Berlin, Rome and Vienna. He took part in the suppression of the Filipino insurrection, in campaigns at Manila, Iloilo, and Sebig Bay, and also in the Boxer campaign. At various times since then he has been in command of the *U. S. S. Iroquois,* of the Pacific squadron in 1906 and 1907, chief in command of ships at the Naval Academy, naval attaché of the American Legation at Buenos Aires, naval attaché at the American embassy, Berlin, fleet commander of the *U. S. S. Michigan,* in command of the 3d seaman regiment at Vera Cruz in 1914. In 1916 he graduated from the Naval War College and has since been a member of the general board. At the outbreak of the war Admiral Niblack was ordered to command division 1 and later squadron 1 of the Atlantic fleet. In November, 1917, he was placed in command of squadron 2, the patrol forces and the United States naval forces based on Gibraltar. He commanded the naval forces of the United States in the western Mediterranean until after the armistice and in the eastern Mediterranean and the Adriatic from January to March, 1919; on April 1, 1919, he was made director of Naval Intelligence of the Navy Department.

Vice-Admiral A. P. Niblack, U. S. N.

John B. Matthews, consulting engineer and surveyor, 24 California street, San Francisco, Cal., has just completed preliminary plans for an electrically driven passenger liner for the Oceanic Steamship Company, of San Francisco, Cal. Mr. Matthews' engineering experience began in 1901 when he worked as an apprentice in the machine and pattern shops and drafting rooms of the Pennsylvania Iron Works, Philadelphia, Pa. He remained here until 1905, when he went with the William Cramp & Sons Ship & Engine Building Company, Philadelphia, Pa., in the engineering department. During the three years he was with this company he completed a special course of studies at the University of Pennsylvania. From 1908 until 1913 Mr. Matthews had charge of the design of machinery at the Lake Torpedo Boat Company, Bridgeport, Conn. For the next two years he was submarine expert at the Brooklyn Navy Yard, as well as in charge of Diesel work and estimating on the battleships *California* and *New Mexico.* From June, 1915, to February, 1918, he was chief engineer of the Bethlehem Shipbuilding Corporation at the Moore plant, Elizabethport, N. J., engaged in designing, standardizing and supervising the construction of ship propelling machinery. Until February, 1920, he was consulting engineer for the Moore Shipbuilding Company, Oakland, Cal.

John B. Matthews

Edwin S. Carman, recently elected president of the American Society of Mechanical Engineers, was born in Prairie Depot, Ohio, in 1878. His high school and business education were supplemented by special instruction and studies in engineering at the Central Manual Training School, Cleveland, Ohio. He began his work in the shops of the Sun Oil Company, Toledo, Ohio, and four years later entered the engineering field with the American Machine and Manufacturing Company, Cleveland, Ohio. He was appointed chief engineer after two years in the engineering department. In 1908 Mr. Carman was engaged by the Osborn Manufacturing Company, Cleveland, to design, manufacture and build up a complete line of foundry molding machines. In 1913 Mr. Carman became directly associated with the Osborn Manufacturing Company as chief engineer in charge of engineering and manufacture of the machine division, and in 1916 he was elected a director and secretary. In 1917 he was appointed works manager of both the machine and brush divisions of the company. Mr. Carman has taken a very active part in the affairs of the American Society of Mechanical Engineers since his election to membership in 1917, and has also found time and opportunity to contribute to the advancement of his local and state engineering organizations.

E. S. Carman

HOWARD C. HIGGINS has opened at 17 Battery Place, New York city, a brokerage office for the sale, purchase and charter of vessels. For many years Mr. Higgins was superintending engineer of the Old Dominion Steamship Company. With the outbreak of war he became the authorized representative and district manager for the United States Shipping Board Emergency Fleet Corporation, first at the Newark Bay plant of the Submarine Boat Corporation and later at the Hog Island plant of the American International Shipbuilding Corporation. Mr. Higgins is a member of the Council of the Society of Naval Architects and Marine Engineers.

R. W. LEVENHAGEN has recently been made vice-president of the Glidden Company, Cleveland, Ohio. He will be in charge of the auxiliary organization of this company. Mr. Levenhagen began his career in the paint and varnish industry twenty-five years ago with the Sherwin-Williams Company, Cleveland, Ohio, and continued with this company until his present connection. For several years past, he has been secretary of the Sherwin-Williams Company as well as vice-president and general manager of the Detroit White Lead Works, Detroit, Mich., and vice-president of the Martin-Senour Company, Chicago, Ill. Mr. Levenhagen's duty will be to direct the service of the Glidden Company to a higher degree of co-operation with dealers and manufacturers affiliated with the auxiliary organizations.

R. W. Levenhagen

H. B. MILLER has resigned as director of the Division of Supply and Sales of the United States Shipping Board.

CAPTAIN E. W. BONNAFFON, Supply Corps, United States Navy, formerly assistant to the director of the Bureau of War Risk Insurance, has been ordered to duty with the Shipping Board to become the successor of Mr. Miller as head of the Division of Supply and Sales.

RICHARD M. SEMMES has been appointed director of the operating division of the Shipping Board in the Seattle district, vice Dudley W. Burchard, retired. Mr. Semmes served with the Admiral Line for years in San Francisco and Seattle, becoming its general freight and passenger agent. He managed the Independent Steamship Company, operating between Seattle and Southwestern Alaska, and served later as the traffic adviser of the Alaska Territorial Shipping Board. He gave Congress valuable help in the framing of the new merchant marine act. When his appointment as successor to Mr. Burchard was announced recently the news caused general satisfaction in the shipping world of the Seattle district.

WILSON PORTER SMITH, who is now associated with the United States Mail Steamship Company, Inc., 45 Broadway, New York, is in direct charge of the re-conditioning of the S. S. *George Washington,* flagship of the line, and the S. S. *Mount Vernon,* ex-*Kronprinzessin Cecilie,* with offices aboard the S. S. *George Washington,* lying at Commonwealth Dry Dock, South Boston, Mass. Mr. Smith designed the interiors of the public rooms and staterooms on the S. S. *Aeolus,* the re-conditioning of which at the plant of the Baltimore Dry Docks & Shipbuilding Company, Baltimore, Md., was described in our last issue.

ALEXANDER MCDOUGALL, president of the McDougall-Duluth Shipbuilding Company, Duluth, Minn., who has been in Europe on a business trip, was inadvertently referred to on page 93 of our January issue, as Harris McDougal. Captain McDougall is arranging for the construction of a special type of craft known as seagoing canal boats and lake canalers, models of which were exhibited at the recent Marine Exposition in New York.

D. B. CARSON has been appointed Cleveland district sales manager for the Tacony Steel Company, Philadelphia, Pa.

D. J. CROWLEY has been appointed Michigan sales agent of the Tacony Steel Company, of Philadelphia, with offices in the Dime Bank Building, Detroit, Mich.

FRANK THORNTON, JR., chief engineer of the Westinghouse Electric Products Company, has been appointed manager of the electric heating engineering department of the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

OBITUARY

JOHN MCINNES, superintendent of the Bath Iron Works, Bath, Maine, died on January 22, at Port Glasgow, Scotland, as the result of an operation. Mr. McInnes has been with the Bath Iron Works for over twenty years, and at the time of his death was spending the holidays in Scotland with his wife.

B. FRANK WOOD, one of the leading yacht builders on the Atlantic coast, died recently at his home on City Island, New York, at the age of sixty-six years. He was born in Manhattan and at the age of four years went with his father, also a boat builder, to City Island. The business, established in 1861, came into his hands at the retirement of his father about thirty years ago. Many famous yachts have been turned out in his yards, among them being *Irondequoit,* a Canada cup winner; *Felseen,* at one time the fastest steam yacht afloat, and the speed boat *Dixie.*

Ship Data Sheets

A special loose-leaf binder in which to present ship data has been developed by the New York office of the Federal Shipbuilding Company. Until this book was issued in December, 1920, no standard specification form had been arranged by any shipbuilding company for the general information of those interested in technical descriptions of various types of vessels. Profile and deck plans of different types of vessels built by the Federal yard are arranged on inserts and the principal characteristics of the hull construction, machinery, cargo hold arrangements, handling equipment, bunker and tank capacities and locations, tonnage ratings, oil specifications and general remarks on crew and officers' quarters and the like, are given on a page facing the plans so that reference may readily be made from one to the other.

General specifications of the Scotch marine boilers built by the Federal yard have been standardized in a similar manner, so that the description of the construction and fittings of a typical bare boiler, as given in the book in conjunction with a table stating the diameter, number of furnaces and square feet of heating surface for each size, adequately describes every size boiler produced by the company.

Ship machinery details are adaptable to this same form of presentation and folders describing propelling units as well as new ship designs will be issued frequently by the company. These will all be arranged for insertion in the binder.

Shipbuilding and General Marine News

Contracts for New Ships — Shipyard Improvements — Engineering Projects—Improved Appliances—Personal Items

WATERWAY AND TRADE BOOM FORECASTED AS OUTCOME OF CONVENTIONS

Mississippi Valley and South Atlantic States Associations Hold Stirring Sessions at Washington—Forward Movement the Keynote

The development of the internal waterways, the growth of foreign trade, and the balancing of foreign exchange are the three great objects for which we should strive, according to President H. H. Merrick, of Chicago, in his opening address at the second annual convention of the Mississippi Valley Association held at the Willard Hotel, Washington, D. C., January 19 and 20. President Merrick presided at the session.

J. E. Smith, of St. Louis, stated that it was to the commercial interest of the twenty-seven states embraced in the Mississippi Valley to secure the development of a national waterway system. He claimed that 54 percent of our population resided in these states, and that they had a majority of votes in both houses of Congress. Colonel H. H. Haines, of Galveston, Tex., called attention to the fact that the state of Maine, by water transportation, could put its products into Texas cheaper than the states of the Mississippi Valley. He explained the advantage of combining grain with the cotton shipmens from the south and pointed out that it was only 700 miles from Kansas to Texas, as compared with 1,500 miles from Kansas to New York.

Among the other speakers were J. B. Morrow, executive secretary of the association, who urged the administration and strengthening of the Merchant Marine Act of 1920, and J. E. Bollhorn, of Milwaukee, who told of the great terminal and port facilities that Milwaukee was preparing and advocated the development of the St. Lawrence River to connect the Great Lakes with the sea.

A banquet was held on Wednesday evening at the New Willard Hotel, at which short talks on the "Valley Idea" were given by representatives from the various states in the Mississippi Valley. Over 100 congressmen were present.

SOUTH ATLANTIC STATES ASSOCIATION

The United States Shipping Board, in its sales policy, should give the most serious consideration to the establishment of new trade routes, according to President Matthew Hale, of the South Atlantic States Association, at the annual convention of that body held in the Hotel Washington, Washington, D. C., on January 19. Mr. Hale, who is also president of the South Atlantic Maritime Corporation, presided at the convention and in the course of his address outlined the objects of the association, explaining the educational work to be done in regard to the development possibilities of southern ports, and the data and information to be secured and made available by their Washington office.

A resolution was adopted asking all southern railroads to declare their stand on export rates for South Atlantic ports. The prospect of a combination of thirty-two states was seen when it was advocated that it would be greatly to the benefit of the South Atlantic states to join forces with the Mississippi Valley Association.

Extending Graduate Engineering Research Work

To assist in the conduct of engineering research and to extend and strengthen the field of its graduate work in engineering, the University of Illinois maintains fourteen Research Graduate Assistantships in the Engineering Experiment Station. Two other such assistantships have been established under the patronage of the Illinois Gas Association. These assistantships, for each of which there is an annual stipend of $600 and freedom from all fees except for matriculation and diploma fees, are open to graduates of approved American and foreign universities and technical schools who are prepared to undertake graduate study in engineering, physics, and applied chemistry. Additional information may be obtained by addressing the director.

ENGINEERING LECTURES

Members of Ocean No. 80 Have Instructice Programme

Members of Ocean Marine Engineers Beneficial Association, No. 80, are taking an active interest in the course of lectures being conducted in conjunction with the Tuesday evening meetings of the association at 15 Whitehall Street, New York City. The educational department of the association has been successful in arranging a program of speakers of recognized ability, and fully 200 members, representatives of steamship companies and other marine interests are attending the sessions. On January 18, Mr. Eskil Berg, of the General Electric Company, spoke on the subject of "Marine Steam Practice." Mr. Berg had delivered previous lectures to the engineers and he was given an enthusiastic reception. He praised superheat and the Diesel engine, and in his reference to the former subject, emphasized the point that he was not referring to 50 degrees, but of 200 degrees when he mentioned superheat.

At the previous weekly meeting on January 11, J. A. Barnes and G. E. Kershaw, of the Locomotive Superheater Company, gave a joint illustrated lecture on superheat. Mr. Barnes dwelt chiefly on superheat as a means of providing a more efficient power plant and because of which a saving of fuel and water may be accomplished and in the design of new equipment engines and boilers of a smaller size for a given horsepower may be provided. Mr. Kershaw spoke of the practical operation and care of this equipment and answered in detail a number of questions from various engineers present.

The programme thus far prepared by the educational department included the following:

February 1—Mr. J. B. Bassett, General Electric Company, subject, "Diesel Electric Drive."

February 15—Mr. Ernest H. B. Anderson, Parsons Marine Steam Turbine Co., Ltd., subject, "Marine Turbines and Gearing."

March 1—Mr. L. W. Williams, Shipley Construction & Repair Company, subject, "Marine Refrigeration."

Completes First Voyage

The steamship Leda, 321 feet long, which was built by Sir W. G. Armstrong, Whitworth & Company, Ltd., for Det Bergenske Dampskibsselskab, Bergen, has completed her first round voyage between Newcastle and Bergen. She is a passenger vessel.

COMPETITIVE BIDDING URGED ON SHIPPING BOARD TO CUT REPAIR COSTS

Shipping Men Claim Bills Totaling $6,000,000 Are Still Unpaid—Suggest Abolishment of the "Time and Material" Contracts

Although called together by Commander R. D. Gatewood, head of the Bureau of Construction and Repair of the U. S. Shipping Board, to explain why the prices of materials used in ship repair work seemed excessive, the ship repair men took a turn at showing Commander Gatewood and Commissioners Donald and Thompson how the Shipping Board could economize by abolishing the "time and material" basis for contracts and placing all repair work on a competitive basis.

Commander Gatewood bluntly told the score of ship repair men that the time had come when they must submit smaller bills for work done. He painted a dreary picture of the future of the country's merchant marine if this was not done and pointed out that the work could be done more cheaply in Europe.

In reply E. P. Morse pointed out to the commissioners that the repair men were suffering many injustices at the hands of the Shipping Board. William H. Todd, president of the Todd Shipyards Corporation, followed Mr. Morse, and stated that all of the repair people in this district, both large and small, have been very unjustly dealt with by the Board to the extent that their bills, totalling $6,000,000, are still unpaid. Commander Gatewood agreed that this figure was not under-estimated.

Mr. Todd opened the eyes of the two visiting commissioners when he told how, after his concern had finished repairs on the steamer *Hansemund,* the contract having been awarded on a competitive basis, the Todd bid being $39,000 as against the next bid of $98,000, the Shipping Board failed to take delivery of the vessel for nearly a month later. As a result, the vessel broke from her moorings in a storm and did damage to the Todd yard amounting to $30,000, another bill still awaiting payment. This contract was awarded with a penalty clause of $5,600 for every day the repair yard held the vessel beyond the contracted time.

Mr. Todd pointed out in reply to Commissioner Donald's comment that he thought it unfair that twenty-five per cent additional charges be made for painting a steamer while in dry dock, that the Shipping Board should handle the painting the same as private owners do. That is, deal with the painters direct and thus eliminate additional overhead.

In reply to the hint of Commander Gatewood that the Shipping Board may be compelled to invite bids from shipyards outside of New York, Mr. Todd said:

"That suits us. Give us all a chance to bid. That's all I'm asking. We went to Halifax at the request of the Shipping Board, and bid against yards up there for a ship. We got the job and brought it down to New York.

"Only recently bids were opened on a vessel where bids were confined to yards on the Atlantic coast possessing graving docks. The result being that our Robins yard was successful in getting the job, their bid being $475,000 and 90 days time as against the bid of the Newport News Shipbuilding Company's bid of $576,500 and 135 days time."

Mr. Todd took exception to the statements that work could be done more cheaply in Europe and that repair costs in this district are higher than in other districts. He added:

"When you speak of costs in Great Britain, let me say that we can compete with Great Britain right now. You know, Mr. Gatewood and Mr. Donald, that I've been hollering to you for competitive bidding for a long time. You say, Mr. Gatewood, that repairs cost too much, there is absolutely no question that this is the case. The greatest waste, in my opinion, is the manner in which the repairs are ordered and handled by your own organization.

"Just recently you stated to us that you were compelled to give out a big repair job on cost plus basis because the operators were not able to prepare intelligent specifications. Surely, the repair people are not to be blamed for that. It would be better for the Board to wait a few days longer, get the specifications complete and then go into the market and get competitive bids from everyone.

"You are sending tankers to people who do very little work and do not get any of the work they bid on because their prices are so high. Yet the tankers are sent to these firms on a cost plus basis. Simply because their commercial rate is a trifle lower than some of the consistent bidders on your competitive works."

Commander Gatewood said the reason the tankers were sent to the yards referred to was because of their proximity to the oil terminals. In reply Mr. Todd said:

"You know we have yards close by. One yard is not more than an hour and a half away. Let me tell you, gentlemen, that this time and material basis is not the way to reduce the cost of repairs."

"You know, Mr. Donald, if you had a $60,000 job, you'd ask for bids, wouldn't you?"

The commissioner replied it would be a matter for the underwriters if a hurry job was necessary, as in the case of an accident. To the amusement of those present, the veteran shipping man agreed with Mr. Todd that the underwriters would ask for competitive bidding.

Commissioner Gatewood and the commissioners admitted that the system of paying the Shipping Board bills was unjust and worked a great hardship on the repair plants.

"We have bills with you people involving great sums of money since last August." Mr. Todd added, "They are still unpaid. After they have been O.K.'d we get them back months later, with requests for routine details. I don't think that's good business. Don't you think, gentlemen, we ought to be given some consideration in getting our money. Do you think we can work cheaper when we have to wait so long for payment? We can't tell our men to wait six or eight months. I think it would be a good thing if the operators of your ships had the repairs done and paid the bills."

Following Commander Gatewood's announcement that he would look for new rates for material, Mr. Todd said:

"Does that mean you want us to reduce wages? If so, the reduction of wages or overtime of our employees is the farthest thing from my mind. Give me the interest on the money that you owe the men in this room and I'll consider giving you all the material for nothing."

The ship repair men said they were glad that Commissioners Donald and Thompson were at the hearing and expressed their appreciation of the open-mindedness of the commissioners. The small repair men said that while the difference of opinion was between the Board and the bigger plants they felt the industry as a whole would benefit from a general airing of the situation.

BRITISH TANK PRICES

That tonnage prices abroad are very little if any more attractive than American figures is indicated in latest official quotations which offer three British tank steamers now under construction in English yards at £45 per deadweight ton for delivery in May, £43 for delivery in June and £41 for delivery in July.

The vessels are 8,800 deadweight tons, and the price per ton at the present rate of exchange is approximately $166.50 as compared with prices for Shipping Board vessels quoted at from $165 to $185 per ton.

MOTOR SHIP LAUNCHED

The London & Montrose Shipbuilding & Repairing Company, Ltd., recently launched the steel motor coasting vessel *Yuletide* which they have built to the order of A. Besse, Esquire, of Aden, for Messrs. J. Stone & Company, of London. The vessel is 132 feet long, of special design, with large carrying capacity, and is equipped with a single screw Beardmore oil engine of 200 brake horsepower.

NAVAL SOCIETY ISSUES BULLETIN NO. 4

The Society of Naval Architects and Marine Engineers, 29 West 39th Street, New York City, has issued Bulletin No. 4, in which it places a number of new projects before its members. Included in these are the establishment of an employment bureau through which the society is prepared to assist its members in this respect.

FERRYBOAT CONTRACT IS AWARDED STATEN ISLAND SHIPBUILDING COMPANY

Winning Bid $736,430—Sum of $56,900 Asked By Commissioner Whalen to Rebuild The Steamer Mayor Gaynor

Grover A. Whalen, Commissioner of Plant and Structures, New York, on January 19, awarded the contract for the building of a 2,000-ton steel, screw ferryboat for the Staten Island Municipal Ferry to the Staten Island Shipbuilding Company, New York. The bids received were:

Standard Shipbuilding Corporation..	$775,000
United States Steamship Company..	744,700
Staten Island Shipbuilding Company.	736,430

"The persistent rejection of bids has lowered the price for this boat nearly $100,000," said Commissioner Whalen. "Bids have been received five times. Each time I have felt that the best interests of the city required the rejection of the bids." The record of the bids received is as follows:

Date	Staten Island Shipbuilding Co.	United States Steamship Co.	Other Bids
Oct. 11	$827,900	$916,835	$896,000 (Tebo) 947,666 (Newburgh) 1,040,000 (Bethlehem)
Nov. 1	822,000	812,400	875,000
Dec. 9	795,300	789,500	.....
Dec. 29	769,500	769,000	875,000 (Bath)
Jan. 18	736,430	744,700	775,000 (Standard)

"The lowest bid received on this bidding is $91,470.00 below the lowest bid received on October 11, which is a reduction of 11½ percent in the cost of the new ferryboat. This verifies my judgment that the dropping in costs would be reflected in new bids and that the city would save a substantial sum by readvertising the contract.

"The new boat is to be delivered in 275 consecutive calendar days."

$56,900 FOR REPAIRS

In a letter to the Board of Estimate and Apportionment, dated January 10, 1921, Commissioner Whalen made application for the issuance of corporate stock (revenue producing) in the amount of $56,900, for the reconstruction of the ferryboat Mayor Gaynor, so as to make it a serviceable craft. It is further requested that $28,615 of this amount be assigned to personal service schedules and permission is also asked to expend $30,285 of this fund for the purchase of the materials for this work and for contract and open order service in connection with it. Commissioner Whalen states that as a result of the survey made, with a view to determining how to make the boat serviceable, he finds that it can be expected to render good service after the following reconstruction work is done; rebuild boilers A and B; relocate and rebuild boiler C; install a fourth boiler, adding 716 horsepower; reconstruct coal bunker, hatchways, etc.; make additions and alterations to pipe systems, valves, etc., reconstruct ballast system, install new propellers and construct 400 additional seats. The work will be done at the Municipal shipyard at St. George, S. I., with the exception of the casting of new propellers and their installation, which will be done by contract.

Foreign Launchings

The steamer *P. L. M. 23*, the fourth of eight similar vessels constructed by Sir Raylton Dickson & Company, Ltd., was launched from their Cleveland Dock Yard, Middlesbrough, on December 23, 1920. The ship is for La Scapasrie des Chemis de Fer de Paris a Lyon et a La Medeteranneanoe, whose ship business is managed by their subsidiary company, La Societe Nationale d' Affretements. The vessel is 400 feet long, of a deadweight carrying capacity of about 8,900 tons on a light draft of water. Quadruple expansion engines placed aft, having cylinders 23, 32½, 47 and 68 by 48 stroke, supplied with steam by three large single ended boilers having Howden's system of forced draft will be fitted in this vessel and the three sister ships by the North Eastern Marine Engineering Company, Ltd., Wallsend-on-Tyne, while the remaining four vessels will be similarly engined by Richardsons, West Garth & Company, Ltd., Middlesbrough.

Messrs. Harland & Wolff, Ltd., have launched from their Govan shipyard the oil barge *Britmex Number* 11 for harbor and river use, built for the British, Mexican Petroleum Company, Ltd. The boat is 155 feet overall in length and is similar to several others previously built by Harland & Wolff, Ltd., for this company, having all modern equipment.

BUSINESS NOTES

The Mesta Machine Company of Pittsburgh, Pa., announces the opening of a branch office at Chicago, Ill. The offices are temporarily located in the Railway Exchange Building, but will be moved into permanent quarters in the McCormick Building after April 1. The Chicago office will be in charge of Mr. C. J. Mesta, 2nd vice-president of the company. Messrs. W. R. Dawson and R. W. Schutte will be transferred from the Pittsburgh offices to Chicago. The company has recently opened offices in the Singer Building, New York City, in charge of Mr. M. M. Moore who was formerly export sales manager. The company will also retain its office in the Munsey Building, Washington, D. C.

The Larko Range & Manufacturing Corporation has purchased the plant and range business of the Cochran Manufacturing & Forge Corporation at 78th Street and Woodlawn Avenue, Chicago, Ill. The Cochran Corporation and its forge business is now being incorporated as the Great Lakes Forge Company in greatly enlarged quarters at 119th and Racine Avenue.

The Chicago Pneumatic Tool Company announces the appointment of R. F. Eissler as assistant to the vice-president with headquarters at the company's new office building at 6 East 44th Street, New York City. W. C. Straub, formerly district manager of the New Orleans branch, has been appointed district manager of the Pittsburgh branch, succeeding Mr. Eissler, and Ross Wyeth, formerly attached to the Pittsburgh branch, has been appointed district manager of the New Orleans branch succeeding Mr. Straub.

Manager Charles R. Page, of the American Marine Insurance Syndicates, announced that the syndicates have opened an office in Philadelphia, located in the building of Brown Brothers at Fourth and Chestnut Streets. This office will be in charge of Surveyor J. H. Meseroll, who was recently attached to the staff in the New York office. Plans are also under way for the opening of offices in Boston and Norfolk.

Pollak Steel Company Promotions

At a recent meeting of the board of directors of The Pollak Steel Co., D. E. Sawyer was again elected General Sales Manager for the year of 1921 and is located, as in the past, at the New York office of the Company.

S. K. Morrow, formerly manager of operations, is now manager of sales for the three plants, with the offices at Cincinnati works.

C. G. Talbott, formerly assistant manager of operations, is now manager of rolled products for the Marion plant.

A. C. Weihl, for several years superintendent of Cincinnati plant, is now general works manager in charge of operations and productions of the Cincinnati, Chicago and Marion plants.

V. W. Prather, formerly cost auditor for Cincinnati plant, is now general cost auditor of three plants.

TRADE PUBLICATIONS

Multiwhirl Subcooling Condenser.—A bulletin has been issued by the Griscom-Russell Company, New York, describing multiwhirl subcooling condensers designed for use in connection with the refining and subcooling of gasoline and kerosene.

Dodge Heavy Oil Engines.—The Dodge Sales & Engineering Company, Mishawaka, Ind., has issued a catalogue containing an illustrated description of the various types and sizes of Dodge heavy oil engines, together with their application to fishing boats and tugs.

The P. & H. Chronicle.—A catalogue issued by the Pawling & Harnischfeger Company, Milwaukee, Wis., gives the story of the foundation and development of the company. Photographs of the personnel and of the plant, as well as of the products, give an idea of the organization and its work.

Valves and Fittings for Ships.—What is in effect a complete ship handbook has been published by the Crane Company, Chicago. This book includes specifications, drawings and special tables of information for practically every type of valve that might have a use in merchant marine or naval service.

Whitlock Cordage.—A complete history of the equipment of the Whitlock Cordage Company, New York City, is given in a pamphlet recently sent out by this company. Details of the manufacture of different kinds of rope and cord are described and illustrated, together with the price schedules for these products.

Single and Multiple Carbon Dioxide Units.—The Ushling Instrument Company, New York City, has re-designed the carbon dioxide equipment known as style U. Construction details and the method of operating the new apparatus are described in Bulletin 111, which has been published by this company for distribution.

Marine Machinery.—The Kearfott Engineering Company, Inc., New York, has issued a pamphlet outlining the service which the consulting staff of this company is prepared to give in connection with marine machinery installations, as well as the types of mechanical equipment that the company is in position to supply.

Dexter Valve Reseating Machine.—Three types of Dexter valve reseating machines are described in a catalogue issued by the Leavitt Machine Company, Orange, Mass. The three types have been designed for receding globe valves and gate and pump valves. Complete illustrated descriptions of the construction and operation of each, as well as specifications and prices for the various sizes, are given.

Oil and Gasoline Storage Systems.—A looseleaf catalogue made up from descriptive bulletins has been issued by the Wayne Oil Tank & Pump Company, Fort Wayne, Ind. Oil and gasoline storage systems, oil filtration outfits, oil-burning systems, furnaces for metal melting, forging and heat treating are described in detail. Specifications and illustrations are given of practically all the standard products of the company.

History and Development of New York Shipbuilding Corporation.—The American International Corporation, New York, has published a bulletin describing the New York Shipbuilding Corporation at Camden, N. J., which is the largest self-contained plant of its kind in the world. Designed primarily for the construction of large passenger-carrying vessels, the expanded facilities of this yard are contributing to the American merchant marine the most important group of ocean liners now being built for the merchant fleet. Together with this construction, the yard is engaged in building naval vessels. The history of the plant from its foundation, the problems met and overcome by the early organization, and the records accomplished under the stress of war demands are outlined.

NEW INCORPORATIONS

S. S. Cuba, Inc., Wilmington, Del.—To own and operate boats; capital, $1,500,000.

Bay Towing Company, Galveston, Tex.; capital, $100,000; incorporated by W. D. and E. D. Hadden, J. R. Guyton.

Starkey & Cadmus, Norfolk, Va—Ship chandlery; capital, $50,000; incorporated with C. E. Cadmus, president; Thomas Starkey, secretary.

Dobson Raft and Lifeboat Corporation, Boston, Mass., to build rafts and lifeboats; capital, $200,000; by Robert A. Dobson, James R. Glassford and E .W. Flint.

Clarkson Coal & Dock Company, Wilmington, Del.; capital, $5,000,000; by C. T. Cohee, C. B. Outten, S. L. Mackey.

Delaware River Towing Line, Inc., Wilmington, Del., to build, own and operate boats; capital, $150,000.

Detroit Export Finance Corporation, Wilmington, Del., general export and import business; capital, $10,000,000.

Panamanian Ship Corporation, New York, incorporated with a capital stock of $20,000 by E. R. Clare, C. E. Willis and D. Woodhams, 17 Battery Place, New York.

The Atlantic-Pacific Manufacturing Corporation, Brooklyn, N. Y., life-saving equipment; capital, $75,000; by E. W. and C. M. Skoldberg and G. Swanson, 30 Prospect Park, Brooklyn, N. Y.

Gillespie Steamship Corporation, Manhattan, capital $250,000, by George S. Brengle, East Orange, N. J.; Charles F. Quarteill, Brooklyn; P. J. R. McEnlingart, New York.

Goodrich Transit Company, Wilmington, Del. boats; capital, $1,250,000; T. L. Croteau, M. A. Bruce, S. E. Dill.

Netherlands Trading Society, Manhattan, ship brokers; capital, $10,000; H. Deleeuw, E. T. McLoughlin, H. Rosenstein, 523 Metropolitan avenue, Brooklyn, N. Y.

Pamico Transportation Company, Wilmington, Del., boats; capital, $1,500,000; T. L. Croteau, S. E. Dill, A. M. Hoven.

Pensacola-Cuban Steamship & Trading Company, Pensacola, Fla.; capital, $150,000.

S. C. Loveland Company, ship brokers, $250,000; T. L. Croteau, M. A. Bruce, S. E. Dill, Wilmington, Del.

Pacific Ports Service Corporation, wharfage and berthing of steamships, $100,000; T. L. Croteau, M. A. Bruce, S. E. Dill, Wilmington, Del.

Kingston Dry Dock & Construction Company, Kingston, N. Y., 5,000 shares preferred stock, $100 each; 5,000 common, no par value; active capital, $525,000; G. A. Fagan, E. Salisbury, M. E. McGuiness, Kingston, N. Y.

Thomas Line, Manhattan, N. Y., steamship agency, $20,000; G. Painter, H. A. Smith, H. S. Thomas, 163 Eastern Parkway, Brooklyn, N. Y.

Whipple Ship Corporation, Wilmington, Del., the transportation of passengers or freight by water; capital, $100,000.

Truxtun Ship Corporation, Wilmington, Del., transportation of passengers or freight by water; capital, $100,000.

Henn, Vandenberg & Company, Manhattan, ship chandlers, $25,000; A. Henn, Jr., J. Gillespie, E. C. Hadler, 553 Gilmore street, Brooklyn, N. Y.

James E. Kelly, Manhattan, stevedoring, $5,000; E. P. Shell, C. H. and J. E. Kelly, 800 President street, Brooklyn, N. Y.

Portuguese Line, Manhattan, navigation, $5,000; L. W. Simmons, H. P. Pieper, A. F. Egeltropp, no address given.

South Jersey Supply & Transportation Company, 423 Market street, Camden, N. J., transportation business; capital, $125,000.

American-Machado Turbine Corporation, Wilmington, Del., manufacture of turbine engines, etc.; capital, $1,000,000.

The Seaboard & Inland Barge Company, New York, formed by a merger of the Inland Barge Company and the Seaboard Barge Company; capital, $1,000,000; to construct barges and other vessels and operate a general shipbuilding plant. M. and J. Tracy and C. L. O'Connor, 1 Broadway, incorporators

I. H. Aiken Transportation & Towing Company, Pensacola, Fla.; capital, $250,000; Alexina G. Aiken, president; Isaac H. Aiken, vice-president; Thomas W. Saltmarsh, secretary-treasurer.

Atlantic & Gulf Exporting Company, Jacksonville, Fla.; capital, $2,000,000; W. B. Gillican, president, New Orleans, La.; John H. Powell, vice-president, Jacksonville, Fla.; H. L. Richmond, secretary-treasurer.

Steel Products Corporation, El Paso, Texas; capital, $100,000; by J. H. Sanford, Jr., and E. L. Fugale, El Paso, to manufacture iron and steel specialties.

CAPITAL INCREASES

Tebo Yacht Basin Company, Brooklyn, N. Y.; to $1,000,000.

New England Forwarding Corporation, Manhattan, N. Y.; from $50,000 to $200,000.

Brewer Dry Dock Company, Elizabeth, N. J., $30,000 to $1,000,000.

Port Johnson Dry Dock Company, Port Johnson, near Bayonne, N. J., filed notice of change of name to Ballou Dry Dock & Repair Company, and increased capital from $20,000 to $500,000.

The Northwest Engineering Company, Green Bay, Wis., will increase its capital stock from $1,000,000 to $1,300,000. This company conducts a foundry and machine shop, manufacturing marine engines and equipment, as well as a ship construction yard and repair dock.

Whiting Foundry Equipment Company, Harvey, Ill., announces that it has changed its name to Whiting Corporation, increasing its authorized capital stock from $700,000 to $3,000,000. The Whiting Corporation remains under the same management and will continue the manufacture of cranes, foundry equipment and railway specialties as heretofore.

The Cowles Shipyard Company, Buffalo, N. Y., has increased its capital from $5,000 to $30,000.

Tampa Inter-ocean Steamship Company, Tampa, Fla., increased its capital from $300,000 to $500,000.

Beaumont Export & Import Company, Beaumont, Tex., increased its capital from $150,000 to $500,000.

CHANGE OF NAME

At the annual meeting of the stockholders of the Quaker City Steamship Company, general offices at Room 378, Drexel Building, Philadelphia, Pa., held on January 11, the stockholders voted to change the name of the company to the Tidewater Marine Company, and elected the following directors: George R. Dilkes, E. M. Fallon, L. Macandlish, M. L. Hutchinson and J. T. Manning, Jr.

Foreign Trade Development

Recently announced figures indicate that in ten years' time this country developed a merchant marine engaged in foreign trade from little more than 1,000,000 deadweight tons to 15,692,631 tons. In 1910 America's total merchant marine amounted to 11,262,123 deadweight tons, of which 1,173,776 tons were engaged in foreign trade. In 1917 our total tonnage was 13,306,556, of which 3,606,164 tons were engaged in foreign trade. The fiscal year ending 1920 show our total merchant marine to be 25,027,342 tons; of this, more than three-fifths engaged in foreign trade, or a total of 15,692,631 tons.

Motor Passenger and Cargo Ship Launched

The twin screw motor passenger and cargo vessel Margvana, built for the British India Steam Navigation Company, Ltd., was launched on December 24, 1920, from the Clyde home yard, Whiteinch, Glasgow, by Messrs Barclay-Curle & Company, Ltd. She is built to comply fully with the "International Convention" regulations for the safety of life at sea and her principal dimensions are: length, 450 feet, breadth, 58 feet, gross tonnage, 8,500 tons, deadweight carrying capacity, 10,500 tons. Efficient cargo handling gear is being provided with electric winches.

When completed the vessel will embody all of the most up to date features of the motorship. She is rigged as a two-masted schooner and to preserve the characteristic appearance of the vessels of the British-India fleet.

Marine Construction News of the Month

Ship Contracts—New Ship Concerns and Shipyard Improvements—Terminal Projects—Government Contracts

SHIPS AND SHIPBUILDING

Tug, Bridgeport, Conn.—The Bridgeport Dredge & Dock Company is reported to be in the market for a small tug to be used for towing in Long Island Sound.

Floating Equipment, Havana, Cuba.—The V. V. C. Sand & Construction Company, Egido, 2-A, Por Corrales, is in the market for floating equipment, including dipper dredges, barges and tugs.

Passenger Steamer, Vancouver, B. C.—A new steel steamer to carry 1,200 passengers, and with a speed of 14 knots, is to be built at a cost of $200,000 to $225,000, for the Union Steamship Company, it is reported.

Schooners, Maine.—It is reported that Crowell & Thurlow, Boston, Mass., will build several four-masted schooners at Boothbay Harbor and Rockland, and that tenders are out for several other large schooners to be built in other Maine yards.

Keels Laid for Steamers, Vancouver, B. C.—The keels of two new Government steamers, the Canadian Transporter and the Canadian Trader, were laid at the Coughlan Shipyards recently. Several hundred men are engaged at the yards.

Vessel Contract Awarded, Manitowoc, Wis.—A contract for the construction of a vessel for the American Sand & Gravel Company, of Chicago, Ill., has been awarded the Manitowoc Shipbuilding Corporation. Details concerning the boat are as yet unavailable for publication.

Steamers to Be Converted, Victoria, B. C.—Alterations for the conversion of the steamer Princess Adelaide, the first of the Canadian Pacific Railroad steamers to be converted into a coal burner because of the scarcity of fuel oil, are being made at the yard of Yarrows, Ltd.

Orders Placed for Suction Dredgers.—In the face of cancellations of contracts abroad, it is interesting to note that orders for six powerful suction dredgers have been placed by the Indian Government with two Renfrew concerns which specialize in the construction of vessels of this type.

Freighters, Germany.—It is stated that the Schichau Company, operating important shipyards at Danzig and Elbing, is building a number of new vessels for foreign account. The Elbing Schichau yards are busily engaged in the construction of freight steamers for Denmark, each of which has a carrying capacity of 3,000 tons.

Vessel Launched, Newark, N. J.—The steamer Sujerseyco was recently launched at the Port Newark yards of the Submarine Boat Corporation. Twenty-eight of the thirty-two vessels which the company is completing for its own account have now been launched, leaving four now on the ways.

To Enlarge Fleet, New York.—According to a report credited to Col. F. W. Fraley, Southwestern representative of the Sinclair Refining Company, that company will soon add nine new tankers to its fleet of about twenty of these vessels, with a view to increasing the importation of Mexican crude oil.

Steamer to Be Reconditioned, San Francisco, Cal.—Fletcher Munson, connected with the Hanlon Shipyards, has purchased the steamr Oakland from the Albers Steamship Company, and after an extensive overhauling plans to place the vessel in the copra-carrying trade between San Francisco and the South Seas.

To be Converted into Oil Tankers, Beaumont, Tex.—The Beaumont Dry Dock & Shipbuilding Company will convert the Ferris type hulls stored at Beaumont into oil tankers. Out of twenty-five of these bottoms stored at Beaumont, twenty-three are now at the yards of the Beaumont Dry Dock & Shipbuilding Company.

Activities at Oakland, Cal.—It is reported that the Moore Shipbuilding Company, Oakland, Cal., will shortly start work on three tankers of 76,000 barrels capacity for the Shipping Board, and that the concern is now in receipt of contracts for the building of several fuel carriers for the Standard and Union Oil Companies.

New Steamer Completed, Weehawken, N. J.—A new steel hull sightseeing steamer, the Visitor, has just been completed by the Weehawken Dry Dock Company for the New York Harbor Sight Seeing Company, with offices at 15 Park Row. The steamer is 100 feet long, 20 feet wide and 9 feet deep, and it is the intention of the owners to use her in daily trips around Manhattan Island.

Reconditioning Steamer, Antwerp, Bel.—The Canadian Pacific Ocean Services, Ltd., London, has contracted with the Antwerp Dry Dock & Engineering Company for the steamer Scandinavian, of 12,000 tons, to be overhauled and repaired and painted inside and out. The Melita, another of the company's big liners, is also reported to be at the Antwerp yard for extensive reconditioning.

Freighters, Oakland, Cal.—The two 14,500-ton deadweight freighters, Manulani and Manukai, building for the Matson Navigation Company, for their service to the Hawaiian Islands, will be ready for service within two months, according to W. P. Roth, vice-president and general manager of the Moore Shipbuilding, Oakland, Cal., at which yard these vessels are under construction.

New Tonnage Prospects.—It is announced from the International Mercantile Marine Lines at 9 Broadway, New York, that the American Line recently took over from British Registry and raised the American flag on the new 17,000 ton British liner Minnekahda which it has fitted out as a third class passenger liner for the Hamburg trade and is understood to be in the market for other tonnage.

Ferryboats, San Francisco, Cal.—The Six-Minute Ferry Company is arranging for the construction of three all-steel ferryboats, to be completed within the next five months, for operation between San Francisco and Oakland, Cal. A slip on the north side of the Ferry building has been assigned to the company, and a site for the erection of slips has been secured for the docking of their vessels across the bay.

Fleet Increase.—The Isthmian Steamship Lines of New York have ordered a 33 1/3 percent increase in the fleet which it operates in the intercoastal route touching Puget Sound and Pacific Northwest ports. The number of sailings from Seattle is to be increased from two or three a month in January, and if sufficient tonnage develops it is expected that the corporation can give Seattle a sailing each week later in the year.

Equipment for Vessel.—The S. Flory Manufacturing Company, Bangor, Pa., has a contract for four combination capstans and windlasses for an 8-yard bucket dredge being built by the Staten Island Shipbuilding Company, Port Richmond, S. I., New York, for the Victor R. Browning Company, Cleveland, Ohio. This dredge is being constructed for operation in Hell Gate and is claimed to be one of the largest of its type ever built.

Halifax Outlook Bright.—Following announcement of the launching of the 3,000-ton steamer Canadian Explorer at the plant of the Halifax Shipyards, Halifax, N. S., on December 18, statements are credited to a shipyard executive that a further expansion of their activities is to be looked for in the near future, and that should developments eventuate as anticipated, the plant will have sufficient work to carry it well into next year.

Three Vessels Ordered, Washburn, Wis.—The Anchor Shipbuilding Company has a contract for the construction of a steel ferryboat for Hudson River service. The vessel is to be equipped with full Diesel propelling machinery and is scheduled for delivery early in 1921. Additional contracts have also been secured for a steel steam lighter for Chesapeake Bay service and a steel motor cargo vessel, both of which vessels are for 1921 delivery.

Tug, New York.—The firm of Tams, Lemoin & Crane, naval architects and marine engineers, 52 Pine street, New York, has just designed a new tug, construction of which is expected to begin in the immediate future. The vessel is to be of heavy construction and designed in accordance with American Bureau's rules, to be equipped with a Scotch boiler and compound engine, electric light plant and all necessary fittings for best economy.

Pacific Coast Shipyard Busy With Repairs, Oakland, Cal.—The Moore Shipbuilding Company is repairing the steamers, Quabbin, 10,000 tons; the Quilwark, 9,400 tons; the Eastern Ocean and the Rotarian. At the Union Iron Works, San Francisco, the Associated Oil tanker William F. Herrin is receiving a new tailshaft and a propeller hub. Four vessels are undergoing repairs at the Barnes & Tibbitts yards on the east side of San Francisco Bay.

Reconstructing Freighter, San Francisco, Cal.—It is reported that the Toyo Kisen Kaisha plans to enter the oil-carrying trade from Mexico to the Orient direct. To this end the company plans to reconstruct the 17,000-ton freighter Kiyo Maru to carry fuel. It is understood, however, that no action will be taken until one of the several vessels now under construction in the Mitsubishi shipyards will be ready to replace the Kiyo on the run to Valparaiso.

New Passenger Liner, Gothenberg, Sweden.—The fastest Diesel-drive passenger liner in the world will be constructed for the Swedish-American Line in Gothenburg, Sweden, and will be placed in service some time in 1922. The vessel will be 590 feet long, with a beam of 72 feet, and will have accommodations for about 1,500 passengers, including first, second and third class. To attain a speed of 18 knots, machinery of 16,000 indicated horsepower will be installed.

Patrol Boats, San Francisco, Cal.—Commissioned to investigate shipbuilding on the Pacific Coast and to place orders for Government vessels for the Dutch East Indies up to $4,500,000, R. G. Leegraste, a naval architect of Java, arrived at San Francisco, Cal., recently. He will seek to obtain favorable terms for fast patrol boats with a speed of at least 18 knots, for use in the coast guard service in Java. The vessels will be from 900 tons up, and must be triple screw and powered with Diesel engines.

Four Freighters.—The four 20,000-ton Diesel ore carriers to be constructed for the Ore Steamship Company, a subsidiary of the Bethlehem Steel Corporation, and to cost about $5,000,000 each, will be equipped with the new Diesel engine designed by Arthur West, consulting engineer. Two of the vessels and their engines will be built in the Bethlehem corporation's San

Francisco, Cal., plant, while it is understood that the other two ore carriers will be built at the Sparrows Point yard of the Bethlehem Shipbuilding Corporation.

New Steamer for Island Service, Honolulu, T. H.—According to information received from the Interisland Navigation Company has prepared plans and specifications for the construction of a large passenger and freight steamer for service among the Hawaiian Islands. The vessel will be about 314 feet long, 41 feet beam, with a speed of 16 knots, will be modeled after the old Oceanic steamer Alameda, and have a passenger accommodation of 250 in the first and second class. The vessel, say the advices, will be built in a San Francisco yard. ,

Barges, Pittsburgh, Pa.—It is announced that the Carnegie Steel Company has placed an order with the American Bridge Company, Pittsburgh, Pa., for the construction of twenty-five steel barges, to be delivered next July. The vessels will be 175 feet long and 25 feet beam, with a depth of 11 feet. According to the available information these barges will be used primarily to convey coal along the Monongahela River to the Carnegie plants, but will be so constructed as to enable them to make outside trips to Southern ports with finished steel products as the need arises.

New Tankers.—Approval of the construction of four oil tankers of a total deadweight tonnage of 42,300 tons is announced by the Shipping Board, under the terms of Section 23 of the Merchant Marine Act. Three bulk oil carriers of 10,200 deadweight tons each will be built in the yards of the Bethlehem Shipbuilding Corporaton for the Pan-American Petroleum & Transport Company of New York, and the American Sugar Transit Corporation of New York will build a tanker of 6,300 deadweight tons at the yard of the Staten Island Shipbuilding Company.

New Fireboats, Philadelphia, Pa.—On approval of the Director of Public Safety and after consulting a number of construction experts, Mayor Moore has signed a contract with Cornell & Matthews to prepare plans and supervise the construction of a fireboat, and probably two fireboats. The boat will be of steel, propelled by a single screw, and will be 129 feet 9 inches long, 28 feet beam, and 12 feet 9 inches deep. Four turbine driven fire pumps with a total discharge of 10,000 gallons per minute will be installed. When completed this new vessel will be the most powerful fireboat in existence.

Japanese Company Quits New Building.—Owing to the continued shipping depression and to the fact that ten of the surrendered German ships have been allotted to Japan, it is reported that the Nippon Yusen Kaisha has abandoned its program for the construction of 500,000 tons of new ships with the exception of about 180,000 already built or ordered. Under the program the company has already acquired fourteen freighters aggregating about 100,000 tons. Six 7,000-ton freighters are being built, and will be delivered next year as well as three freighters of the 19,000-ton type, and two passenger steamers.

Shipbuilding Activities at San Pedro, Cal.—The United States steamer Pinole will go on the dry dock of the Los Angeles Shipbuilding Company for a general overhauling, and upon completion the dry dock crew will begin on three other steamers which are waiting their turn. The new dry dock will soon be completed, and following that event a large Standard Oil Tanker will be raised. The Los Angeles Shipbuilding Company has just launched the steamer Ora, which is the last of the 8,800-ton steamers to be built in the yards for the Emergency Fleet Corporation. The keel for a 11,500-ton steamer for the Shipping Board will very soon be laid.

New Plant to Construct Schooners, Portland, Ore.—Mr. G. F. Matthews, a shipbuilder, intends upon the completion of the schooner Undaunted, upon which he is now working, to remodel another Ferris type wooden steamer hull into a sailing vessel. Mr. Matthews recently purchased an extensive tract of waterfront, and the work of converting the second steamer hull into a sailing craft will be performed at the plant which he intends to erect on this site. The schooner Undaunted is being created in the Grant Smith Porter shipyard, in St. Johns, Ore., from an uncompleted hull, which was left on the ways of the yards when contracts for wooden steamers were canceled by the Emergency Fleet Corporation.

Big Shipping Deal, Vancouver, B. C.—Announcement is made of the sale of the Terminal Steam Navigation Company, to Union Steamship Company of British Columbia. The deal is the largest in shipping affairs in Vancouver this year, involving, it is understood, several hundred thousand dollars. Not only is Captain J. A. Cate's line of steamers included in the sale, but the entire park and farm property at Bowen Island also goes to the Union Steamship Company. The Union Steamship Company, through its general manager, John Barnsley, announced that it has arranged to take over the steamers and plant of the Terminal Steam Navigation Company, involving about $250,000. The company intends to build a new passenger vessel.

Ship Contracts Approved.—The Shipping Board has approved applications for the construction in accordance with the provisions of Section 23 of the Merchant Marine Act, 1920, submitted by the following companies of the vessels indicated in order that they may obtain the benefits of the provisions of the said section: Alaska Steamshp Company, 120 Broadway, New Todd Dry Dock & Construction Company, Tacoma, Wash.; Calvert Navigation Company, Baltimore, Md., steel tanker, 10,200 tons deadweight, Baltimore Dry Docks & Shipbuilding Company, Baltimore, Md.; Sinclair Navigation Company, 120 Broadway, New York, two bulk oil tankers of 6,900 tons deadweight each, Bethlehem Shipbuilding Corporation, Harlan Plant, Wilmington, Del. Atlantic Coast Company, one schooner at Thomaston, Maine, one schooner at Rockland, Me., 2,400 tons; Frey-Flynn Company, Harrington, Me., one schooner 1,750 tons; Stockton Yard, Inc., Stockton Springs, Me., one schooner; Luckenbach Steamship Company Inc., New York, one tanker, 8,800 tons, Southwest Shipbuilding Company, East San Pedro, Cal.; Standard Oil Company of California, San Francisco, two tankers, 21,800 tons, Bethlehem Shipbuilding Corporation, Alameda plant; one tanker, 5,140 tons, Moore Shipbuilding Company, Oakland, Cal.; two tankers, 12,500 tons, Union Construction Company, Oakland, Cal.

SHIPYARDS AND DRY DOCKS

Shipyard Addition, Perth Amboy, N. J.—The Perth Amboy Dry Dock Company, foot of Broad Street, operating a shipbuilding and repair plant, plans a one-story addition to its machine shop.

Shipyards Installations, North Tonawanda, N. Y.—The Disappearing Propeller Boat Corporation, Robinson Street, is arranging for the installation of machinery at its new plant. Neill Wilson is manager.

Marine Railways, Port Neches, Tex.—A set of marine railways is to be built at the plant of Swails, Hance & Rawlings Construction Company. The plant builds all classes of vessels and also operates marine railways.

New Shipyard, Tarpon Springs, Fla.—The M. S. T. Shipbuilding Company has purchased river frontage at Tarpon Springs, on which to erect shipyards, equipped for building and launching light vessels, such as barges, etc.

Boat, Engine and Propeller Plant, Jacksonville, Fla.—L. C. Windle has established a plant known as the Disappearing Propeller Boat Company for the manufacture of boats, engines and propellers. F. E. Hewitt, Detroit, Mich., is general manager.

New Shipbuilding Plant, Saginaw, Mich.—The American Safety Navigation Company has plans under way for the construction of a new shipbuiding plant to cost more than $1,000,000, work on which is to begin at an early date. R. A. Graham is president of the company.

Shipyard Expansion, New Orleans, La.—The new plant of the Marine Iron Works, 1012 Magazine Street, will be two stories instead of one as previously announced. It will be 75 by 115 feet, and will be equipped as a machine shop and forge works, at an estimated cost of $75,000. A. J. Krail is vice-president.

Shipyard Addition, Manitowoc, Wis.—The Manitowoc Shipbuilding Company, 16th Street and Manitowoc River, is receiving bids for building a one-story 60 by 180-foot power house, of brick, reinforced concrete and steel, reinforced concrete flooring, brick foundation, on 8th Street, involving about $75,000. Private plans.

Lighter, Beaumont, Tex.—The Beaumont Shipbuilding & Dry Dock Company was awarded a contract by the Penn-Mex Fuel Company of Tampico for the construction of a 105-foot shallow draft self-propelled lighter, to be equipped with 80 horsepower Wolverine engine and to have provisions made for a derrick with two six-ton booms.

Dry Dock, Victoria, B. C.—Contract for the construction of the new Government dry dock at the Esquimault navy yard has been awarded to P. Lyall & Sons, of Montreal and Vancouver, on the firm's tender of $4,300,000, which was about $200,000 less than the Government's estimates, it is said. The dock will be 1,150 feet by 120 feet.

Shipyard Equipment, etc., Jacksonville, Fla.—The Merrill-Stevens Shipbuilding Corporation is planning to improve the shipyard of A. Bentley & Sons, which they recently acquired as a repair yard, and will make extensive additions, including equipment, involving the expenditure of about $400,000. J. E. Merrill is vice-president and general manager.

Buy Shipbuilding Plant, Portland, Ore.—With the intention of building steam schooners and barges, Carl Christiansen and Ham McCormick have bought the plant of the St. Helens Shipbuilding Company, Portland, Ore. Carl Christiansen has been superintendent of the company for a number of years. The plant has been building barges during the past few months.

To Expand Government Repair Yard, Pascagoula, Miss.—Plans are in progress for the enlargement of the Government boat yards. Major-General North, United States engineer in charge, states that this enlargement is planned for the purpose of making this yard a place for repairing all craft of the Engineering Department used in the Southern Division, including New Orleans and Pensacola, as well as Mobile.

Shipyard to Be Converted, Savannah, Ga.—The Savannah Coal & Dock Company recently organized, has acquired the former shipyard of the Foundation Company, New York, at Savannah, and is said to have perfected plans for erecting a coal-loading and handling plant, to be built at an estimated cost of $200,000, including hoisting, conveying and other machinery. It will have a capacity of 75,000 tons of coal a month, and will be augmented by a larger plant during the coming year, with a daily capacity of about 10,000 tons of coal.

New Shipbuilding Facilities at Chester, Pa.—Eight slipways at the Sun Shipbuilding Company's plant at Chester, Pa., are being extended landward so that a different form of tanker than has been constructed can be built. The new ships, of which four are for one company, will be 480 feet long and capable of carrying 12,000 tons deadweight, making them the largest built. From the bed of the Delaware River 30,000 cubic yards of material have been removed by the Sun Shipbuilding Company to provide a wet basin and dry dock costing $1,500,000, and in which the largest steamship afloat can be accommodated when the work is completed.

Yard Ready for Operation, Washburn, Wis.—The new wooden shipyard of the Anchor Shipbuilding Company was placed in operation on a contract for a vessel with 200-foot keel and 50-foot beam, designed for use as a ferry on the Hudson River at New York. The present plant consists of one way, but three additional slips are being dredged and will be completed during the winter. The Anchor Company is reported to have contracts on its books and in prospect to keep four ways busy during the 1921 season. It will build wooden ships only for the present. The organization was projected originally in the fall of 1918, but did not begin plant construction

until early in 1920. It is a $500,000 corporation organized under the laws of Wisconsin. Robert Curr is general manager.

PORT IMPROVEMENTS

Seawall, Bay St. Louis, Miss.—Specifications have been completed for building a concrete seawall.

Docks, Houston, Tex.—The Crown Oil Company will construct a dock on the city's harbor lines at Houston, Tex.

Lake Improvements, Kissimmee, Fla.—The city has issued $34,000 bonds for lake improvements. Address the Mayor.

Improve Water Front, Boynton, Fla.—The city has voted $10,000 to improve the ocean front and their electric lighting plant.

Seawall, Matagorda, Tex.—Matagorda Precinct No. 2, W. E. McNabb, commissioner, contemplates the construction of a seawall.

Municipal Wharves, Beaumont, Tex.—The city, A. B. Steinhagen, Mayor, will construct municipal wharves to cost $500,000. O. A. Seard is engineer.

Ferry Improvements, Wilmington, N. C.—The New Hanover County Commissioners issued bonds for $50,000 to be used for ferry improvements at Wilmington.

Improving Water Front, Newark, N. J.—The City Commission has authorized the issuance of $1,250,000 bonds to improve the water front and deepen Newark Bay.

Wharves, Beaumont, Tex.—The city will construct docks and wharves and extend water systems, etc., for which it has voted $2,250,000 bonds. Address the Mayor.

To Deepen Channel, Tampa, Fla.—The Atlantic Coast Line is preparing to deepen the channel at its terminal so that a heavier cargo may be loaded on vessels at that dock.

Docks, Houston, Tex.—The city will remodel its cotton docks involving an expenditure of $200,000, and is having plans and specifications prepared by the city engineer's office.

Wharf, Detroit, Mich.—The City Fire Commission let contract for building a 335-foot reinforced concrete top wharf to A. J. Dupuis & Company, 1022 Ford building; $160,889.

Wharves, Charleston, S. C.—H. F. Barkerding let a contract to the Jefferson Construction Company for building a 177-foot wharf and slip. An additional building will be erected later.

Wharf Destroyed by Fire, New Orleans, La.—The wharf of the Cuyamel Fruit Company at Desire street and the river was recently destroyed by fire, with a loss estimated at from $200,000 to $300,000.

Docks and Wharves, New Orleans, La.—Arrangements have been made by the International Harvester Company with the New Orleans Dock Board for the construction of docks and wharves to cost $250,000.

River Terminal Improvements, Minneapolis, Minn.—The city has authorized the issuance of $350,000 bonds for river terminal improvements, including docks, levee trackage, etc. F. W. Cappelen is city engineer.

Piers and Bulkheads, New York.—The Red Star Towing Line has let a contract for building several small piers and bulkheads costing about $55,000, to the Robbins-Ripley Company, 50 Church street, New York.

Water Route to Coast.—Representatives of ten states attended the meeting at Birmingham, Ala., of the Atlantic to Mississippi Canal Association, which proposes to establish a direct water route from the Middle West to the Atlantic seaboard.

Improve Docks, Vancouver, B. C.—Work has been started on the graving dock to be built at Vancouver by the Coughlin Shipbuilding Company, of which J. J. Coughlin is the head. Engineers are making preliminary borings. The cost of this improvement will be about $3,500,000.

Pier, Equipment Etc., Jacksonville, Fla.—A bond issue of $1,000,000 to construct an additional pier at municipal terminals has been recommended to the City Council by the City Commission. Two large warehouses and extensive loading equipment will be provided for in the measure recommended.

Deepening Channel, Baltimore, Md.—Among other plans for the improvement of Baltimore harbor, a movement is on foot to deepen the channel to a mean low water depth of 40 feet to the Capes, to enable the larger vessels such as the 20,000-ton ore freighters now being built at Sparrows Point, to enter the Patapsco.

Dock, Goat Island, N. J.—H. L. White, special representative for the Texas Oil Company, New York, was in Elizabeth City, N. J., recently with an engineer, making surveys and soundings at Goat Island, to find a suitable location and depth of water for a new dock which the company will build as soon as plans can be drawn.

Pier Nearing Completion, Equipment, Etc.—The Port of Tacoma, Wash., will issue $60,000 of warrants bearing 6 percent interest, in order to complete its port project to the extent of placing Pier 1 into commission. The funds will be applied to the purchase of a big crane and other equipment, as well as laying railroad tracks to the new pier.

Wharf, Houston, Tex.—The city architect has been authorized by the City Council to advertise for bids on the construction of a wharf at the Turning Basin on the Houston Ship Channel for the use of the Houston-Tampico Steamship Line, carrying freight and passengers. The project will cost about $15,000.

Dredging, Cape May, N. J.—An expenditure of $80,000 has been recommended by Major-General Lansing H. Beach, chief of the army engineers, for the dredging of the Cold Spring Inlet at Cape May, N. J. The Philadelphia & Reading Railroad is understood to contemplate building coal docks on the harbor as soon as the dredging has been completed.

Channel.—Lake Charles, La., is seeking a 30-foot channel to the sea, connecting the Gulf with the proposed route of the inter-coastal canal through Lake Charles, and making that city a deep-water port. The city recently entertained a number of engineers, inland waterway experts, United States and State Senators, and others interested, on an inspection trip over the proposed route of the channel several months ago. The cost of this project is estimated at $4,000,000.

Harbor to Be Improved, San Francisco, Cal.—The Board of State Harbor Commissioners, Ferry building, has acquired 280 acres of submerged land in Islais Creek and India Basin, and had tentative plans prepared for improving the same. Before anything further can be done, however, it will be necessary to get an appropriation from the government to dredge up to the Pier Head Line, also permission of the United States District Engineer Office to make above improvements.

Terminal Improvements, Tampa, Fla.—It is estimated that the building and equipment of docks, warehouses and coal bunkers will cost about $1,500,000. The Seaboard Dredging Company, Tampa, has the contract for dredging a slip 800 feet long and 250 feet wide as the first step in the construction of municipal terminals on the 1,400-foot channel frontage. A second slip will be dredged and equipped later on. A belt line railroad giving every road entering the city access to the docks will also be built.

Wharf, Transit Shed, Etc., San Francisco, Cal.—The State Harbor Commission, Ferry Building, San Francisco, Cal., is having plans prepared for a 100- by 1,000-foot wharf, a six-story 100- by 800-foot reinforced concrete warehouse and transit shed, double platform on water side with traveling cranes, and served with three tracks of Belt-Line Railroad, also reclaiming five acres between Third street, Channel street and Pier 46, involving 250,000 cubic yards of earth fill; about $2,500,000. F. G. White, Ferry building, is engineer.

To Force Building of Bulkheads, New York City.—Murray Hulbert, Commissioner of Docks, has asked the Sinking Fund Commission to take action compelling holders of water grants from the city who have not done so to comply with the conditions of their grants by building bulkheads and constructing streets or to forfeit the property to the city. According to Mr. Hulbert, many of the grants date back to 1863, and several generations of the owners have enjoyed the enhancement of the value of the property without fulfilling their obligations to the city. Much of the property in question is owned by the Astor estate.

Dock Improvements, Portland, Ore.—The Public Dock Commission has decided to condemn all old docks along the water front which show depreciation of 40 percent or more, and to give the owners two years' time in which to remove the structures. Pending the expiration of the two-year period owners will be permitted to make temporary repairs. The Public Dock Commission has notified the County Commissioners that the old Lower Albina ferry landing will not be restored to the county, and that if the ferry is to be resumed another slip must be provided. The land portion of the old ship will be utilized by the commission for an open dock.

To Build Ocean Terminal, Los Angeles, Cal.—Plans for the transformation of the Terminal Island frontage at Los Angeles harbor into a large ocean terminal is now under discussion. City Engineer Griffin has laid before the City Council the plans for improving this important part of the harbor, and they include the building of 3,200 feet of wharves on land now owned by the Salt Lake Railroad. Ultimately the city plans to build two great warehouses each 500 feet long and 100 feet wide to store freight received at these docks. The Harbor Commission has set aside $2,100,000 worth of harbor bond money to pay for the city's share of the improvement, and unless this work is pushed the city subjects itself to the danger of losing the government appropriation of $150,000 set aside several years ago for widening the channel.

Rivers and Harbors Project, Jacksonville, Fla.—Nearly $2,000,000 has been asked from Congress in the budget for improvement of the rivers and harbors for use in the Florida district. A considerable part of this amount will be spent on the development of the port of Jacksonville and dredging the St. Johns River, from Jacksonville to Palatka, at shallow places to enable schooners to go direct to Palatka to load lumber for Northern ports, thus obviating the necessity of trans-shipping this material to Jacksonville docks. The 18 miles of waterway from Jacksonville to the ocean will be dredged to not less than 30 feet in depth at any part of the channel, so as to permit vessels of large tonnage to come into the port. The engineer's report recommends that a sum of $606,000 be appropriated to carry forward this work during 1921.

American Terminal at Hamburg.—It is announced by the International Mercantile Marine Company, 9 Broadway, New York, that an up-to-date American steamship terminal will soon be constructed in Hamburg, financed by American capital, equipped with American machinery and used exclusively by American steamships. It is to be built on the Ross quay, one of the largest dock structures in Germany, and will have a total length of nearly half a mile with a depth of water alongside to accommodate the largest passenger liners now operated by the American Line from New York. The latest type electric cranes will be installed and trackage will be laid to connect the terminal with through rail lines that will carry American products to interior points in Germany, Czecho-Slovakia, Rumania and other Central-European countries.

GOVERNMENT WORK

Redredging, Texas.—The United States Engineer, Washington, D. C., rejected bids received November 24 for redredging the Galveston Channel.

Dredging.—The United States Engineer Office at Norfolk, Va., will receive bids until February 7 for the dredging of the channel in Norfolk harbor.

Harbor Development, Great Lakes, Ill.—Specification 4358, the Bureau of Yards and Docks, Navy Department, Washington, D. C., plans extensive harbor improvements at Great Lakes, Ill.

Lighthouse Tender.—Sealed proposals will be received by the Superintendent of Lighthouses, New Orleans, La., until 2 P. M., March 2, for furnishing all labor and material to completely construct, equip and deliver the 65-foot twin-screw wooden lighthouse tender Aster.

Steamer Repairs, Baltimore, Md.—The United States Bureau of Survey has awardd contracts for repairing the steamers West Cobalt for $1,190, the Waukesa for $840, and the East Indian for $2,145, to the Baltimore Dry Docks & Shipbuilding Company, and the Lake Ellerslie for $1,090 to the Spedden Shipbuilding Company.

Electric Drive Equipments, Oakland, Cal.—The Coast Guard Service has placed orders for four electric drive equipments for cutters which will be of the 3,000 horsepower synchronous motor type. The hull for the first cutter was recently laid at the yard of the Union Construction Company, Oakland, Cal., which holds the contract for the construction of all four cutters.

FOREIGN ACTIVITIES

New Jetty.—Messrs. John Lysaght, Ltd., Newport, England, have decided to construct a new jetty on the east side of the River Usk to accommodate vessels of between 2,000 and 3,000 tons; the wharf will be 300 feet long and will be constructed to deal with incoming raw material.

To Build Passenger Steamer.—It is stated that the Canadian Pacific Ocean Services, 8 Waterloo Place, Pall Mall, London, S. W., England, in-ends to build a passenger steamer for the Toronto-Niagara Line. She is to be 410 feet long by 70 feet beam, and will carry 4,000 passengers. One of her attractions will be a moving picture theater.

Shipbuilding Merger.—It is announced that the Northumberland Shipbuilding Company, Ltd., has acquired from a group of South Wales shipowners their interests in the Monmouthshire Shipbuilding Company, Ltd., which owns the National shipyard at Chepstow. In view of the new controlling interest, Lord Glanely, T. E. Morel and T. H. Mordey retire from the board of directors.

Launch First Ship.—The Newcastle Shipbuilding Company, Ltd., showed its rapid progress recently when the company launched the 3,050 gross ton steamer Zabalbide, the first vessel to be launched at its Hebburn-on-Tyne yard, and at the same time formally opened its new shipyard. Besides the Zabalbide, the company have on hand three vessels of 4,150 tons deadweight for Norwegian interests, the construction of which is well under way, as well as three tankers of 10,250 tons deadweight, for which keels were recently laid.

Resume Dredger Building.—The two shipbuilding companies at Renfrew, Scotland, Wm. Simons & Company, Ltd., and Lobnitz & Company, Ltd., whose work in normal times consists mainly of dredger building and the supply of dredging plant of all kinds, have gradually been returning to this special class of work after having completed a very large and varied volume of war-time tonnage, and it is now announced that contracts have been placed by the Indian government with both firms for the construction between them of six powerful suction dredgers for service at different ports in India.

Passenger Liners, Germany.—One of the most interesting reports from Germany received recently is that the two new steerage carriers which the Hamburg-American Line is building, and which it anticipates will be ready in the spring for the New York-Hamburg service, will be driven by Diesel engines. R. H. M. Robinson, vice-president of the United American Lines and president of the Merchant Shipbuilding Corporation, is now in Germany going over the plans of the Hamburg-American Line for its passenger steamers. The Harriman interests expect to start upon the construction of two 650-foot passenger liners some time in 1921.

Motorship Construction in Scandinavian Yards.—The Odenze Shipyard at Denmark, a recently organized shipyard, is engaged in the construction of two large steel motorships for Fred Olsen, of Christiania, in which twin-screw Burmeister & Wain Diesel engines are to be installed. The new Baltic Shipyard, at Copenhagen, which was originally laid out to construct turbine-driven ships, is now building two 6,000-ton motorships for a Copenhagen ship-owning company. The Orensundsvarvet, of Landskrona, have also turned to motorship construction and are building two large motorships for Lan Brostrom interests. One of the vessels is of 10,400 tons, and the other of 4,450 tons. The Nakskov Shipyard, which built the East Asiatic Company's motor tanker "Mexico" and the Orient Steamship Company's motor-freighter "Indien," is also concentrating on motorship construction.

Contracts Abroad

Latest reports from abroad announce the placing of numerous contracts for new ships and ship repair work, including the following:

An order for a tank steamer of 11,000 tons deadweight has been received by the Chantiers Navales Francais, Caen, France, from the Société Navale de L'Ouest. This vessel will measure 465.76 feet by 56.97 feet. The propelling machinery will consist of geared turbines developing 3,000 horsepower in giving a speed of 11 knots. The vessel is to be delivered in fourteen months.

The White Star liner Baltic is to be reconditioned at the Belfast yard of Harland & Wolff, Ltd., and the work is expected to take several months for completion. The new 16,000-ton liner now building at this yard for the same line, and which is to be equipped with geared turbines, will be named the Doric, and is expected to be launched about May. This firm has also begun the construction of a large vessel for the Atlantic Transport Company service between London and New York.

It is reported that the plant of the Dominion Shipbuilding & Repair Company, Toronto, which was closed about two months ago, is to be reopened in order to construct two 4,000-ton boats for the Canadian Government, under the supervision of the Collingwood Shipbuilding Company. The work is to be done under arrangements made with the Canadian referee of shipping and the liquidator of the Dominion Shipbuilding Company.

The Clan Line, which is owned by Cayzer Irvine & Company, Ltd., is to send to Portsmouth for alteration and re-outfitting three steamers which they have purchased from the Admiralty for conversion into merchant ships for use in tropical waters.

Reconditioning Olympic

Harland & Wolff, Ltd., of Southampton, are overhauling the White Star liner Olympic at Southampton, which will not sail again until March. The Red Star liners Lapland and Zealand are also to be overhauled at Southampton. The White Star liner Arabic, which was the ex-German liner Berlin, is being refitted at Southampton. In order to make her fit for the Mediterranean service to New York it has been necessary to construct a great amount of new accommodations.

Equipment Figures

Compilation of figures of the North Eastern Marine Engineering Company, Ltd., showing activities of that company at its Wallsend-on-Tyne and Sunderland works for the current year of 1920 show that a total of forty-two vessels of 96,572 indicated horsepower were fitted with machinery and boilers. Nine vessels were fitted with new boilers only. In their superheating department they manufactured and fitted "North Eastern" smoke superheaters to thirty-one vessels. The average indicated horsepower handled yearly for five-year average is 83,368.

MARINE SOCIETIES

AMERICA

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Navy Department, Washington, D. C.
President—Capt. A. J. Hepburn, U. S. N.
Secretary-Treasurer—Commander J. S. Evans, U. S. N., Bureau of Engineering, Navy Department, Washington, D. C.
Annual meeting and election, first Tuesday in October, other meetings at call of the President.

SOCIETY OF NAVAL ARCHITECTS AND MARINE ENGINEERS
29 West 39th Street, New York.

NATIONAL ASSOCIATION OF ENGINE AND BOAT MANUFACTURERS
29 West 39th Street, New York City.

UNITED STATES NAVAL INSTITUTE
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Secretary and Treasurer—Commander H. K. Hewitt, U. S. N.

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National President—John H. Pruett, 423 Forty-ninth St., Brooklyn, N. Y.
National Treasurer—A. B. Devlin, 187 Randolph Ave., Jersey City, N. J.
National Secretary—M. D. Tenniswood, 308 Vine St., Camden, N. J.

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National Secretary-Treasurer—Geo. A. Grubb, 356 Ellicott Square Bldg., Buffalo, N. Y.

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GRAND COUNCIL, N. A. OF M. E. OF CANADA
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GREAT BRITAIN

INSTITUTION OF NAVAL ARCHITECTS
5 Adelphi Terrace, London, W. C.

INSTITUTION OF ENGINEERS AND SHIPBUILDERS IN SCOTLAND
39 Elmbank Crescent, Glasgow.

NORTHEAST COAST INSTITUTION OF ENGINEERS AND SHIPBUILDERS
Bolbec Hall, Westgate Road, Newcastle-on-Tyne.

INSTITUTE OF MARINE ENGINEERS. INCORPORATED
The Minories, Tower Hill, London.

ITALY

COLLEGIO DEGLI INGEGNERI NAVAL E MECCANICI IN ITALIA,
Via Carlo Alberto 18, Genova.